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MORE GOODS AT LOWER PRICES

To restrict production and to raise prices as a general policy is, to me, not liberalism but reaction, not statesmanship but surrender, not creative advance but cowardly retreat. That way lies the subsidizing of inefficency. That way lies the sabotage of superior management that knows how to bring both the cost of production and the price of products down. That way lies a permanent and perilous lowering of living standards for the swarming millions. It was not for this that the pioneers builded their blood and sacrifice into the foundations of this nation. More goods at lower prices is the logical goal of an age of science and technology!

GLENN FRANK

FIRST ENUNCIATED last Spring by Dr. Glenn Frank, at the Chicago "Preview of Industrial Progress," and more recently explained and elaborated into his great book, "America's Hour of Decision," the above statement reveals a philosophy which, to us at least, is the most encouraging development of recent months. It stands out squarely against certain current trends in our federal government. It challenges, logically and unequivocally, the false doctrines of those who would penalize the type of progress with which we, as chemists and engineers, have been most closely identified. It is the first step in the direction not only of business recovery but of the recovery of public confidence in science and technology.

Whether we always admit it or not, there has been a popular revolt against many of the things for which we stand. What Dr. Frank calls the "temper of the crowd," has changed markedly during the depression. Where the man in the street once regarded Science as a generous benefactor, he has come to think of it lately as a ruthless machine that threatens his economic security. Only such a change in the public's attitude toward technology can explain why the now completely discredited doctrines of the Technocrats spread over the country like wildfire a few years ago. Without our knowing it, that same attitude was soon to be translated into the budgetary policies of our local, state and federal governments. Appropriations for science and education were cut far beyond the dictates of enforced economy. In Washington, some of the scientific and technical bureaus were practically decimated at the very time that new emergency agencies were being improvised, often to attempt to do empirically much the same tasks for which scientific methods and data had previously been available.

But the revolt found its most drastic expressions in the N.R.A. and A.A.A. Codes that now seem extremely selfish and shortsighted fixed prices, limited production or banned the installation of new and more efficient equipment and processes. Fortunately for chemical industry, its leaders held out steadfastly against any such compromise of the basic principles on which it had been built. At the risk of criticism as being reactionary and non-cooperative, these men insisted that there should always be unhampered opportunities for research and new technology. More goods at lower prices meant to them the higher living standards that can only be reached through scientific advance.

All of this may seem to mean little at the moment to chemical engineers or to executives faced with a multiplicity of current problems. Yet it probably has more direct bearing on chemical industry than any other. Our laboratories hold a backlog of many millions of dollars worth of research. Our treasuries hold more financial resources, actual and potential, than any other comparable industrial group. Why should we not go ahead? We shall when, as chemical engineers, we realize that our greatest contribution is in the creation of new wealth through new technology. We shall when, as executives, we realize that instead of curbing our capacity to produce, we must release our full productive resources to make more goods at lower prices.

From an EDITORIAL *Viewpoint*

Industry's Most Pressing Problem

LAST JUNE the President appointed a Committee on Economic Security to study this problem and to suggest a practical program for meeting the most imperative needs. This group has been making a thorough investigation of every phase of the subject and will make its final report in December, in ample time for consideration by the new Congress, which is certain to discuss and probably legislate some form of unemployment and old age insurance. As individuals, we, too, should seriously consider the feasibility and practicability of such a program, since any legislation that may be passed is certain to affect everyone of us irrespective of whether we are employees or employers.

Experience with legislative provisions for old age and unemployment insurance in this country is distinctly limited. The Wisconsin program has only recently been put into effect and the other efforts are confined to the trade union plans, the so-called joint agreements and the several projects of private companies. But in England, Germany, Belgium and other European countries, programs have been in operation longer and include much greater numbers of employees. Unfortunately, at the inception of many of these plans the gigantic unemployment figures of the last few years could not be foreseen and it became necessary to modify and revise the procedures from time to time. In the case of the English and some others, however, they are now on a self-supporting basis, and the favorable results being obtained are quite different from what many of us may have imagined.

A study outline, entitled "Twenty Questions on the Economic Security of the People," has recently been prepared by the Industrial Department of the National Council of Y.M.C.A.'s in cooperation with a group of industrial, insurance and labor leaders. We commend it to all *Chem. & Met.* readers who are willing to invest a few hours in thoughtful consideration of one of the most pressing problems of our times.

Alertness Needed In Foreign Trade

GERMAN foreign trade is necessarily moving less smoothly under the many administrative regulations now in force. American chemical manufacturers doing export business will find both inconvenience and advantage in this. There will be distinct difficulty when the export from the United States is into Germany. There may be some advantage when that export from the United States goes into territory served both by American and German companies. It is to be hoped that alertness of American concerns will gain more advantage from the latter situation than the disadvantage which is inevitable because of the difficulty in moving chemicals into Germany.

Is Domestic Iodine "An Inefficient Industry"?

OUT IN CALIFORNIA are three struggling producers of iodine—a commodity that is vitally essential to human welfare. They have never at any time been able to produce the entire requirements of this country, which are in the neighborhood of 600,000 lb. per year, although their peak production probably reached 1,000 lb. per day. The important point is that after these American plants had demonstrated their capacity, the Chilean syndicate that had for years monopolized the field began to cut its prices. From the old pegged level of $4.65 per lb., prices dropped to $2.95, then to $1.95 and are now at approximately $1 per lb. In other words, as the result of the operations of these three American plants, the users of iodine in the United States are being saved over $2,000,000 a year that formerly went in excess profit to a foreign producer. Yet, according to the definition of those who now appear to determine our tariff policies, this is an "economically inefficient industry." According to these tariff theorists, it should be sacrificed in order that Chile may increase its purchasing power for American pork and automobiles.

As made in Chile, iodine is a byproduct of the nitrate industry. Little or nothing need be charged against its production costs for the preparation of the brine, which incidentally is more than one hundred times richer in iodine than the oilwell brines from which the American supply is obtained. Chilean production costs are perhaps 25 cents per lb. or even less. In American plants the diluter brine requires more costly recovery processes and labor is much higher, so that it would not be surprising if domestic costs were three or four times those of the foreign industry.

Awake to this situation, our iodine producers have carried on research that should eventually lead to further economies, provided they are not forced out of business in the meantime. They have also extended their studies of new uses for iodine as a chemical raw material, and at the present low prices there would seem to be some promising possibilities in this direction. Can we afford to abandon all this? Haven't we an economic right to produce iodine in this country? Isn't the record of this industry in the actual savings it has already effected for the American public ample eco-

nomic justification for its existence? In fact, might it not even be worthwhile to put a sufficient tariff on iodine to make certain that we are never again at the mercy of a foreign monopoly?

More About Slaked Lime

IN THIS ISSUE we bring together a few of the comments which we have received on the problems of lime slaking and slaked lime utilization. We called this commodity "The Hydrate of Confusion" in a recent editorial. Perhaps even more critical language would have been justified. We fear so from some of the comments we have received.

This situation is a challenge to the lime manufacturers. Surely they cannot continue indefinitely to sell their product on a basis which ignores the scientific utilizations in a variety of process industries. This field happens to be the most active and growing market available. It is the considered opinion of *Chem. & Met.* that the lime producers should take steps as a group to study more thoroughly the fundamental principles of lime slaking in relation to the properties and usefulness of this important industrial chemical.

The Greeks Had a Word for It

NEONYMOLOGY, the science of coining new words (neonyms), has an ever broadening field of application. Witness the several thousand synthetic names for synthetic plastics cited in the new Directory of Plastic Products that appears on pages 589 to 596 of this issue. But even the resourceful assistant director of the Mellon Institute of Industrial Research, Dr. William A. Hamor, whose pioneer work in neonymology has attracted international attention, must now relinquish the stage—at least temporarily—in favor of the inimitable research consultant of the Dow Chemical Co., Dr. William J. Hale. His new book, "The Farm Chemurgic," interests us tremendously.

What means this neonym, "Chemurgic"? We get little help from the sub-title: "Farmward, the Star of Destiny Lights Our Way!" So we turn to the author's preface and there we find "Chemurgy, from the Greek χημεία (black art of Egypt, or chemistry) (chêmi = Egypt) and ἔργον (work), is that science concerned in the working with and for chemical compounds."

Now may we admit the very narrow, personal and selfish reason for our interest? For years we have wrestled with the embarrassing problem of explaining the name of this magazine to the sweet young things who answer the bosses' telephones or insist on knowing all about us before we are ushered in. Usually, when we get to about the middle of *"Metallurgical"* in our third spelling, we switch to a new tack and try out our more euphonious nickname *"Chem. & Met."* Sometimes, it works, provided the young lady is certain we are not trying to kid her. But how much more impressive it would be merely to say, *"The Journal Chemurgic"* or if the change of name must be more gradual, how about *"Chemurgical Engineering?"* Even if we had to spell it thrice, there would still be a saving of thirteen letters per spelling. Science is indeed a wonder-worker, and we owe a deep debt of gratitude to the newest of our neonymologists, good old Billy Hale!

Reports of Its Death . . .

RECENT DEVELOPMENTS in the nitration process of sulphuric-acid manufacture suggest a striking parallel with the case of Mark Twain, reports of whose death, he is said to have remarked, were much exaggerated by the newspapers. For several years there has been evidence that the old chamber process was finished, at least so far as any new construction was concerned. Although interest abroad in intensive systems such as the Gaillard, Mills-Packard and tower systems such as the Peterson had continued, to American engineers it had become increasingly evident that nothing then on the horizon justified new faith in the nitration process, in the face of the greatly reduced capital investment required by the latest contact plants.

We added our voice to the chorus and helped sing the requiem of the chamber. But now it begins to look as if we might have to eat our words. True, nothing outside the laboratory has occurred to change the relative economics of the two processes. What the laboratory now discloses must pass through the stages of engineering development before it can be proved to have regained the nitration process laurels. But there it is, waiting for plant-scale development—evidence that the better understanding of the nitration process which has recently come from the laboratory may make it yield production of the order of a hundred, even a thousand times as much acid per unit of volume as the process has yielded heretofore.

More than a single experimenter has promised remarkable things for a latter day metamorphosis of the chamber process. In addition to Dr. Ernst Berl's exposition of the pressure synthesis system, which was a feature of the Institute's Pittsburgh meeting and which appears in this issue, there is the one tower system of the Russians, Samarski and Ziberlich, which was described a year ago in *Zhurnal Industrialnoi Khimii,* a system which either with or without pressure may step up production and simplify the plant in a remarkable way. Both processes depend for their success to a considerable extent on controlling reactions which in the past have been permitted to take their own sweet course. Either, if successful even to the extent of half its indicated possibilities, may very well relegate the contact plant of the future to its original duty of producing acid more concentrated than about 80 per cent.

DOMESTIC

By PAUL D. V. MANNING

Pacific Coast Editor
Chem. & Met.

Airplane view of iodine plant of General Salt Co. and adjacent plant of Oil Operators, Inc., Long Beach, Calif.

ONE BY ONE the American process industries are adding to the list of domestically produced chemicals, formerly supplied only from foreign sources. Frequently, the domestic production of such a chemical results in a very drastic cut in price by the foreign monopoly in an effort to make American production so unprofitable that it will shortly cease. Such has been the case with iodine which is one of the latest additions to the number of products that American manufacturers can supply in quantities ample for all domestic requirements.

With the exception of a small quantity of iodine made from kelp in various countries such as Japan and Scotland, practically all of the world's iodine is produced from solutions which arise in the manufacture of other commodities. In Chile, the mother liquors from nitrate production form the raw material for the iodine industry. These liquors normally have an average iodine content of eight grams per liter when sent to the iodine plant. The original nitrate ore, "caliche," averages 0.10 per cent iodine. In the United States, iodine production is entirely from the brines that are pumped, along with the oil, from California oilwells.

As with the mother liquor from Chilean nitrate, not all of these oil well brines contain iodine in quantities sufficient to make its recovery worthwhile. The oil well brines also contain other materials including oil emulsions and very finely divided silt which greatly complicate the production of pure iodine. The corrosive nature of the brines and materials used added to the fact that the plants are situated near the ocean where fogs are encountered, also makes a real problem of the selection of materials for economical construction and maintenance of equipment.

The plant of the largest producer, General Salt Co., is located near Long Beach, Calif. On account of the nuisance caused by ejecting waste waters contaminated with oil into the sea adjacent to public beaches the oil producers have installed a "community" processing plant which removes the greater part of the oil from the brine (see *Chem. & Met.*, Sept., 1931, p. 550). The resulting brine is sent to the iodine plant in quantities as high as 3,000,000 gal. per day. The analysis of this water does not vary greatly. Composition of a sample analyzed last May is given in Table I.

It will thus be seen that the mother liquors of the Chilean nitrate industry, used for iodine manufacture, have an average iodine content over 150 times as high as that of the oilwell brines.

The brine from the treating plant is not entirely free from oil but is pumped into large dirt vats where more of the oil is removed with the aid of the prevailing winds which to some extent concentrate the surface film at one end of the vat, from which it is removed by skim-

IODINE INDUSTRY

Demands Recognition

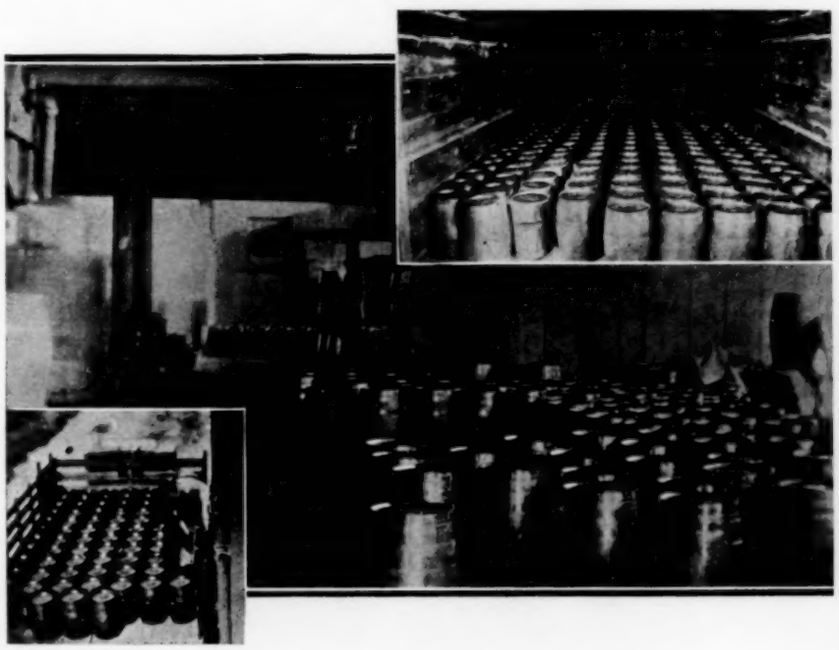
ming. As the water passes to the final settling vat, a portion of the chemicals (sulphuric acid and sodium nitrite) used to liberate the iodine is added and mixed thoroughly with the brine by a rapidly rotating pump runner on a vertical shaft. Bronze is used for this equipment but only a 90-day life is obtained.

The acidified brine is then allowed to settle whereby part of the impurities is removed. As it passes into two trapizoidal shaped adsorption tanks the remainder of the reacting chemicals is added. The chemicals used are sulphuric acid and sodium nitrite. Each of the adsorption tanks has a capacity of 300,000 gal. They are constructed of concrete coated with a ½ in. layer of asphaltic material (Pioneer Flintkote) and are still in good shape after over three years' service.

Activated carbon, "Nuchar No. 2," is added and kept in suspension by ten bronze, propeller-type agitators. It requires about 1¼ hr. to fill the tank and about 20 min. to reach the end point and finish the agitation. The mixture is allowed to settle for an hour and the supernatant liquid decanted through a series of iron gate valves at one end of the adsorption tank. This part of the cycle requires about 1¼ hr.

Where iodine is recovered from oil well brines

Storage and shipment of American made iodine showing first consignment to foreign markets



A number of successive batches of brine are run into the tank before removal of the carbon to insure its maximum saturation with iodine. When careful chemical control at every point in the process indicates that the carbon has reached the proper point of saturation, the slurry remaining from the final decantation is pumped into large concrete walled filters with canvas-covered filter bottoms. Beneath the filter elements is a concrete chamber which is maintained at a 20-in. vacuum during the filtration. The liquor is returned to the adsorption tanks while the carbon, after draining from 6 to 8 hr., and containing 60 per cent moisture, is shoveled into agitating tanks and treated with a hot solution which leaches out the iodine as sodium iodide. The liquor is removed by a leaf filter and passes to shallow evaporating tanks fired directly with gas. The concentrated solution is

cooled in a forced-draft, wooden cooling tower and then passed to a wooden tank. Sulphuric acid is added with thorough agitation. Organic impurities rise to the surface and are skimmed off. The carbon now freed from iodine re-enters the process.

The iodine is then liberated from the purified liquor by chlorine and steam in a specially developed apparatus constructed of concrete and lead. Surprisingly, lead stands up better than any other metal yet tried. The vapors pass to the regular sewer-tile type iodine condensers on dollies. At intervals the condensers are opened and the iodine removed, drained, and purified by the Girvin Process (U. S. Patent 1,857,632), by melting under concentrated sulphuric acid. The iodine cake is then removed, crushed, washed with water, and dried in a current of warm, dry air which is finally scrubbed with a solution of caustic soda. The resulting iodine is an extremely pure and uniform product.

Throughout the process the most satisfactory materials of construction are rubber, wood, Navy bronze, and iron. Certain of the more expensive corrosion-resistant alloys have been found to be satisfactory but the high initial cost makes it economical to use iron or bronze with more frequent replacements.

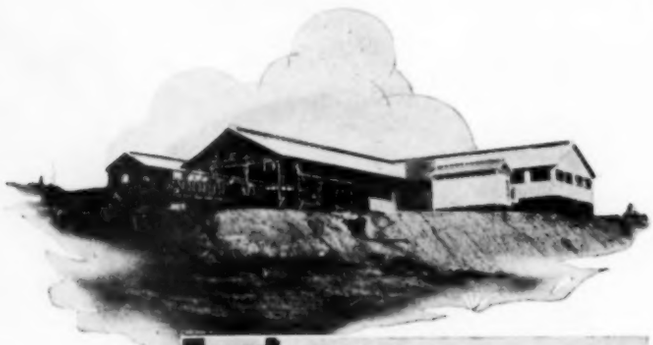
Although at present time it is manifestly impossible for this young industry to show as low a production cost as that of the Chilean producers, continued research is constantly lowering costs and it is deemed probable that the industry may eventually reach the point where the low concentration in the American raw material will be offset by the freight on the foreign product.

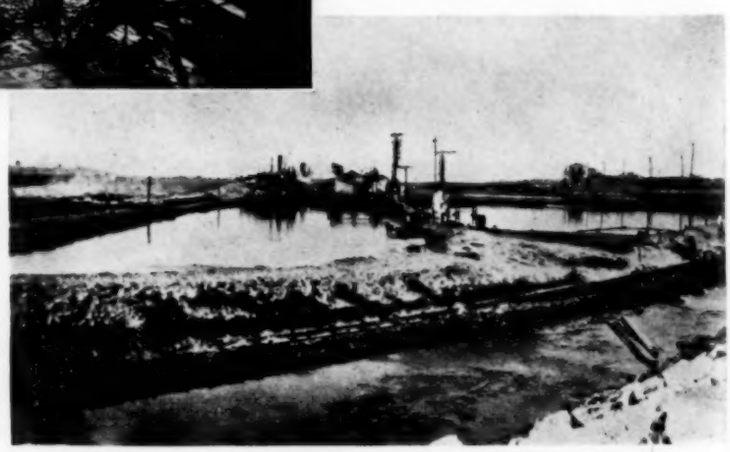
Foreign Trade in Iodine

As domestic production increased, imports of iodine have declined according to a recent report of the Chemical Division of the U. S. Dept. of Commerce. From 926,500 lb. valued at $2,900,000 in 1927 they dropped to the low point of 278,700 lb. valued at $998,000 in 1931. Notwithstanding this decline the invoice price of imports increased from $3.13 to $3.58 per lb. Following 1931, however, the invoice price began to decline, dropping to $3.52 in 1932, and imports rose to 631,670 lb. During the year following the average import invoice price dropped to $2.08 per lb. but imports advanced to 1,411,680 lb. the largest amount ever brought into the United States during a single year. Receipts continue heavy amounting during the first seven months of 1934 to 1,243,500 lb., valued at $1,867,500 or about $1.50 per lb.

Table I—Analysis of Brine to Iodine Plant

	Parts per Million
SiO_2	34
Fe_2O_3 and Al_2O_3	55
Ca	520
Mg	234
Total alkali as Na	10,759
SO_4	40
Cl	15,100
HCO_3	1,584
I	50
Br	90
Total solids	28,301
Mineral solids	26,781
Volatile and organic materials	1,600
Calculated Hypothetical Combinations	
NaCl	27,344
$MgCl_2$	920
$CaSO_4$	57
$Ca(HCO_3)_2$	2,105





At top. Research laboratory and pilot plant of the General Salt Co., at Huntington Beach, Calif. In Center, the adsorption tanks in which activated carbon is added. Below, looking over the dykes of the water storage tanks to the Long Beach plant

Pressure Synthesis a Possibility for Sulphuric Acid Manufacture

By ERNST BERL
Research Professor
Carnegie Institute of Technology
Pittsburgh, Pa.

It is fitting that the man who worked with Lunge, and who, next to Lunge, is probably the world's leading authority on sulphuric acid, should be the one to introduce a concept that may well revolutionize the manufacture of sulphuric acid by the chamber process. Through painstaking steps during his years with Lunge at Zurich before the War; during his service as chief chemist of the Austro-Hungarian war ministry; and since the War during a professorship of fourteen years at the Technische Hochschule, Darmstadt, Germany, he developed the proofs of a mass of theory that now promises enormous multiplication of the speed of the chamber reaction. There are engineering difficulties in the way of successful realization of the pressure synthesis on a commercial scale, it is true. They do not appear to be insuperable, however.—Editor.

A RELATIVELY short time ago sulphuric acid was the most important product of the inorganic chemical industry. It has since lost some of its importance, but not much. The lead-chamber process—which today is not only carried out in lead chambers, but also in towers of brick or acid-resisting material—is one of the oldest chemical processes still in operation on a commercial scale.

Concerning the chemistry of the process, and aside from unfounded opinions, scientists have arrived at two views which up to the present stand in contrast to each other. One group—after Clément, Desormes and Davy—maintains that nitrosylsulphuric acid is the important intermediate substance, while the second group believes with Berzelius that the hydrolysis product of nitrosylsulphuric acid, that is, nitrous acid, forms the intermediate material. I do not agree with this latter theory.

Many years ago we developed a reaction scheme which is described in simple form in Table I. The reactions shown in this table may be divided into three groups, as follows: (*a*) Those which take place in the homogeneous gas phase, as Process 1; (*b*) a second series taking place at the gas-liquid interface, as Reactions 2, 3, 4*a* and 5*a*; and (*c*) those which occur in the liquid phase, as Processes 4*b*, 5*b* and 5*c*.

In the following I shall enlarge upon the single reactions shown in the table and point out which have been proved by experiments and what conclusions in regard to practical output have been or can be drawn.

Reaction 1, according to Lunge and myself, is one of the rare trimolecular reactions which take place in the homogeneous gas phase. Raschig was of the opinion that the nitric-oxide oxidation takes place in two different partial reactions at different speed; that the oxidation of nitric oxide to N_2O_3 takes place with great speed and that the further oxidation of N_2O_3 to N_2O_4 or NO_2 occurs comparatively slowly. The curves of Fig. 1 show the results which we obtained as well as the erroneous conception of Raschig.

During the War and soon after it, Bodenstein confirmed our results with an improved method. The nitric-oxide oxidation does not go through N_2O_3; at lead-chamber temperatures this would be nearly completely dissociated into NO and NO_2. The oxidation reaction goes from nitric oxide directly to peroxide in a trimolecular reaction which, strangely enough, has a negative coefficient of temperature.

Many years ago we asserted that nitrosylsulphuric acid and its reduction product, the so-called "violet acid" which at that time was called "sulphonitronic acid" and which we gave the formula SO_5NH_2, constitute the axis upon which the lead-chamber process revolves. Today I prefer to write the formula for violet acid as a loose molecular compound, $(H_2SO_4)NO$. Manchot believes the composition to be $(SO_5NH)NO$. At that time we had already shown that nitrogen peroxide, sulphur dioxide and water, in conformity with the Reactions 3 and 4*a*, react to form nitrosylsulphuric acid and nitric oxide. We have shown recently that, if nitrogen peroxide and water act upon liquid sulphur dioxide present in excess, violet acid can be produced according to Reaction 3. Violet acid decomposes very easily and quickly at normal pressure into sulphuric acid and nitric oxide. We asked ourselves if this reaction could not be made reversible. It could then

Table I - Reaction Mechanism of Lead Chamber Process
(Lunge - Berl)

$$SO_2 + \tfrac{1}{2}O_2 + H_2O \rightarrow H_2SO_4 + 54 \text{ Kg. Cal.}$$

1	$2NO + O_2 \rightarrow 2NO_2$	Homogeneous in the gas phase
2	$SO_2 + H_2O \rightarrow H_2SO_3$	Heterogeneous on the gas liquid surface
3	$H_2SO_3 + NO_2 \rightarrow \underbrace{(H_2SO_4)\cdot NO}_{\text{Violet acid}}$	
4_a	$2(H_2SO_4)\cdot NO + \tfrac{1}{2}O_2(NO_2) \rightarrow \underbrace{2SO_5NH}_{\substack{\text{Nitrosyl}\\\text{sulphuric acid}}} + H_2O(NO)$	
5_a	$2SO_5NH + SO_2 + 2H_2O \rightleftharpoons 2(H_2SO_4)\cdot NO + H_2SO_4$	
4_b	$(H_2SO_4)\cdot NO \rightleftharpoons H_2SO_4 + NO$	Homogeneous in the liquid phase
5_b	$2SO_5NH + H_2O \rightleftharpoons 2H_2SO_4 + NO + NO_2$	
5_c	$SO_5NH + HNO_3 \rightleftharpoons H_2SO_4 + 2NO_2$	

Slightly condensed from the paper presented by the author under the title of "Studies of the Lead Chamber Process," before the Pittsburgh meeting of the American Institute of Chemical Engineers, Nov. 15, 1934.

be shown that concentrated sulphuric acid, together with nitric oxide, would form violet acid under pressure, according to Equation 4*b*. These experiments were carried out in thick-walled glass capillaries. The sulphuric acid was brought into solidification at low temperature and upon it especially purified liquid nitric oxide was condensed. At the place of contact, a purple red color was immediately noticed. When the capillaries were sealed, upon attaining normal temperature this purple color changed into the deep violet color of the violet acid.

Pressure Aids Violet Acid Formation

We have studied this violet acid in exceedingly drastic experiments. It has been found that its formation, according to Reaction 4*b*, takes place with fewer side reactions the higher the pressure of the nitric oxide. We went as far as 280 atm. pressure in the glass capillaries. As the nitric oxide pressure in the capillaries was lowered, side reactions came to the fore. It is characteristic of all nitrogen oxide-sulphur compound reactions that very rarely do they follow one path. Thanks to their great reactivity, they take different courses if the experimental conditions are changed in a comparatively small range. This is the case here. At 280 atm. nitric oxide pressure, we were enabled to convert 77 out of 100 molecules of sulphuric acid into violet acid. The quantity of byproducts, such as nitrosylsulphuric acid formed by the inversion of Reaction 5*a*, is comparatively small if the nitric oxide pressure is very high. At 200 atm. nitric oxide pressure, for every 100 molecules of nitric oxide converted into violet acid, only two molecules are changed into nitrosylsulphuric acid (see Fig. 2). If one works, however, with 10 atm. nitric oxide pressure, 16 molecules of nitric oxide of each 100 molecules entering into reaction are transformed into nitrosylsulphuric acid. It may be said that the reaction 4*b*, read from right to left, may be almost completely realized at very high pressures.

Nordengreen, Swedish scientist, as well as Waeser, believe that the catalytic reaction is to be credited to a substance which is formed when solid nitrosylsulphuric acid is dissolved in 40 per cent sulphuric acid. By spectroscopic experiments we have shown the error of this opinion.

According to our conception, nitrosylsulphuric acid, which is formed very easily from violet acid and which can be reconverted by reduction processes into violet acid, is the pivot of the whole reaction. In contrast to earlier views, the following may be said:

If nitrosylsulphuric acid is dissolved in strong sulphuric acid, it becomes extremely stable. With increased water content of the sulphuric acid it becomes more and more unstable, according to Reaction 5*b*. There exists a certain concentration interval of nitrose, in which the optimum of the oxidation reaction upon sulphur dioxide is obtained in the presence of oxygen. As optimum, sulphuric acid concentrations of 48 to 62 deg. Bé., corresponding to 60 to 82 per cent sulphuric acid, are to be considered.

Our experiments have shown that a technical roasting gas is catalyzed most advantageously by nitrosylsulphuric acid which is dissolved in 57.5 per cent sulphuric acid. If the concentration of the sulphuric acid rises to 58 deg. Bé., corresponding to 75 per cent H_2SO_4, a considerable decrease of the conversion speed takes place as shown in Fig. 3. The nitrosylsulphuric acid is not sufficiently stabilized and the reaction with SO_2, according on Equation 5*a*, takes place too slowly. On the other hand, if the concentration of sulphuric acid, in which nitrose is dissolved, is decreased gradually, a complete hydrolysis of the nitrosylsulphuric acid occurs and the catalytic oxygen transfer loses in speed. As the sulphuric acid concentration decreases, then, other reactions occur with the formation of byproducts, such as hydroxylamine, nitrous oxide and nitrogen. These side reactions are of no value. They increase the loss of valuable nitrogen compounds. If, therefore, the conception were correct that the hydrolysis products of the nitrosyl sulphuric acid are essentials of the catalytic process, best results would be obtained with very low strengths of sulphuric acid. This, however, is not the case.

In the concentration interval between 60 and 65 per cent H_2SO_4 content the violet acid, according to Equation 4*b*, reaches its maximum decomposition speed. Above 80 per cent sulphuric acid it becomes comparatively stable, while below 50 per cent sulphuric acid it can hardly be formed.

It may be said that the Equations 1 to 5 are absolutely supported by the experiments and that no deficiency exists.

Nitric Acid Not a Catalyzer

Since Peligot (1844) there has existed the idea that nitric acid plays a certain important part as a catalyst in this process. We have found that this is not the case. Nitric acid itself cannot act as a catalyzer. However, it is possible to reduce nitric acid with nitric oxide as we have shown in the absorption analysis of nitric oxide in the presence of sulphuric acid. We can say:

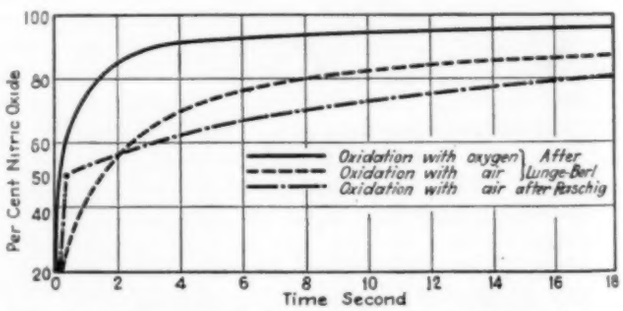
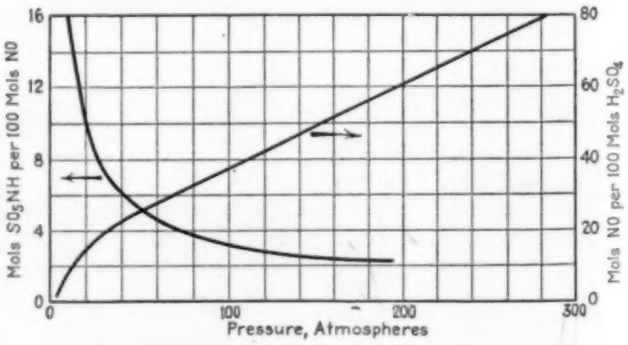


Fig. 1—Time required for oxidation of nitric oxide

Fig. 2—Effect of pressure on the formation of violet acid



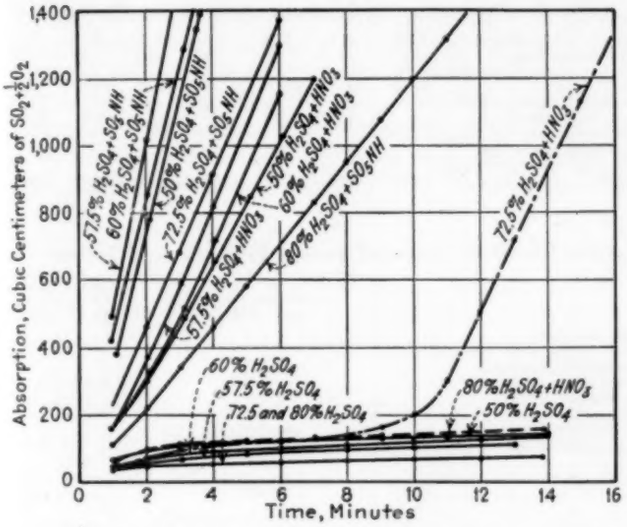


Fig. 3—Absorption of theoretical roaster gas in various mixtures of sulphuric acid with nitrosylsulphuric acid and nitric acid

$$3H_2SO_4 + HNO_3 + 2NO = 3SO_5NH + 2H_2O$$

Also the reduction can be made slowly with SO_2, i.e.:

$$HNO_3 + H_2SO_3 = SO_5NH + H_2O$$

The nitrosylsulphuric acid which is formed in this way may act as a real intermediate product catalyzer as shown in Fig. 3.

It is well known that, as brought out above, nitrosylsulphuric acid is hydrolized by water according to Equation 5*b*. 60 to 62 deg. Bé. sulphuric acid is used in the Gay-Lussac tower for the absorption of the chamber end gases which form nitrosylsulphuric acid. By using more diluted acid in the Gay-Lussac tower or by permitting its dilution with considerable quantities of steam from the last chamber, with the consequent formation of higher temperature, an increase in the nitrose vapor tension takes place, according to Reaction 5*b*. We have determined the vapor tension of nitroses within the range of concentration of 50 to 62 deg. Bé., at temperatures of 30 to 150 deg. C. We believe that by these measurements a service has been rendered to the industry which previously was unable to explain the unavoidable nitrogen-oxide losses. (*Editor's Note*—The results of these experiments have been developed by the author into a nomographic chart which will appear in a later issue of *Chem. & Met.* Use of the chart, according to Dr. Berl, makes possible the determination of everything necessary for theory and practice regarding the lead-chamber process at normal pressure.)

Losses of "High Oxidized" Gases Explained

It is known that when the so-called "high-oxidized" end gases enter into the Gay-Lussac tower, the nitrogen losses increase considerably. The opinion until now was that this was explained by the slow speed of solution of N_2O_4 in sulphuric acid. Based on our experiments, we would state the following:

If nitrogen peroxide is dissolved in strong sulphuric acid, nitrosylsulphuric acid and nitric acid are formed. According to Equation 5*c*, an equilibrium between these four substances takes place and an increase in the nitrose tension. It may be seen from Fig. 4 that in the presence of nitric acid the nitrose tension becomes much greater. For the plant chemist the situation is not very simple. If the gases are not sufficiently oxidized, that is, if nitric oxide is present in excess of nitric peroxide in the ratio of 1NO to $1NO_2$, nitric oxide escapes unabsorbed. On the other hand, if highly oxidized gas is present, the nitrogen peroxide, according to Reaction 5*c*, will not be completely transformed into $SO_5NH + HNO_3$.

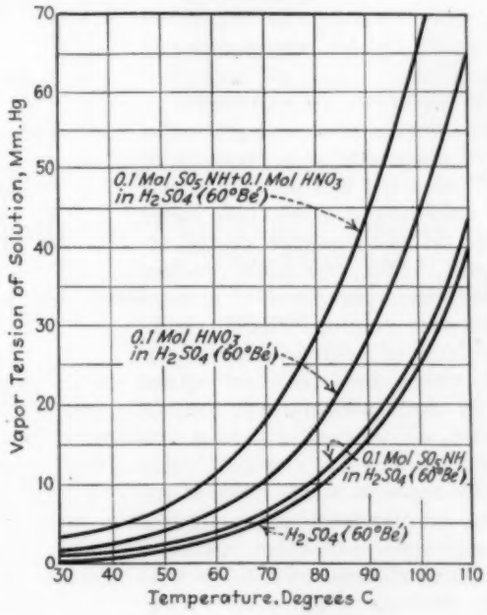
Considerations Leading to Pressure Synthesis

Modern technology is developing essentially along the line of greater intensity of industrial processes. Care is taken to get a larger output per working volume through suitable measures. This question has also been in the mind of persons occupied with sulphuric acid problems. The output of the lead-chamber systems per cubic meter and per day has been increased by enlarging the circulating nitrose gas quantities by suitable construction of the whole apparatus, by application of filling material and by removal of the reaction heat. The question which we asked ourselves was this:

Would it be possible to increase considerably the output per cubic meter per day over that which has previously been obtained? Our reflection in this regard is as follows:

Reaction 1 is trimolecular. Its speed is very much influenced by pressure and increases with the third power of pressure. If, for instance, Reaction 1 were the slowest reaction in the reaction series, an increase in pressure would lead to extraordinary increase in speed. Reactions 4*b*, 5*b* and 5*c* take place in the liquid phase with great speed. They are practically independent of pressure. The Reactions 2, 3, 4α and 5α take place on the surface of contact between the gaseous and liquid phases. Their course is influenced by enlargement of the contact surface. The pressure influence is given by the law of Henry, that is, that the effect is in proportion to the pressure. Reaction 4*b* is also influenced by pressure. Pressure works in the sense that the decomposition of the violet acid be-

Fig. 4—Vapor tension of solutions of nitric and nitrosylsulphuric acids in 60 deg. Bé. sulphuric acid


Vapor Tension of Solution, Mm. Hg
Temperature, Degrees C
0.1 Mol SO_5NH+0.1 Mol HNO_3 in H_2SO_4 (60°Bé)
0.1 Mol HNO_3 in H_2SO_4 (60°Bé)
0.1 Mol SO_5NH in H_2SO_4 (60°Bé)
H_2SO_4 (60°Bé)

comes more difficult. This is very important, because formation of nitric oxide is more or less avoided and, therefore, the slow re-oxidation Reaction 1. Instead of these reactions, Reaction 4*a* becomes more important. It occurs with high speed if the contact surface is great enough and the partial pressure of oxygen and nitrogen peroxide is increased by pressure. We can say that in the old systems Reactions 4*b* and 1, with the formation of NO, take place while in the pressure catalytic reaction, Reactions 4*a* and 5*a* are maintained and the formation of NO and its relatively slow re-oxidation can be avoided to a great extent.

Pressure Synthesis Experiments

As mentioned previously, in the modern chamber process the contact surface between gas and liquid has been increased by suitable means, such as spray tops, rollers, etc. If both factors were combined, that is to say, increase of pressure and enlargement of the contact surface between gas and liquid, it would be possible to get a much greater output per unit of volume and time. To test this theory the production of sulphuric acid under pressure was carried out in careful experiments. A wet roast gas was produced by passing a mixture of nitrogen and oxygen of suitable composition through a cooled solution of sulphur dioxide in water. The reaction was carried out in a leaden vessel which contained the nitrose and which was shaken up. The results of the production of sulphuric acid under pressure may be seen from Table II and Fig. 6. We demonstrated that the yield per unit of volume and unit of time rises proportionately with the square of the pressure. From this evidence, which applies principally to the apparatus and the working method used, as illustrated in Fig. 5, it may be seen that Reaction 1, the speed of which is dependent upon the third power of the pressure, is not exclusively decisive for the results.

That the yield is proportional to the square of the pressure is the result of several factors influencing the total reaction. Besides the dependency of the trimolecular Reaction 1 on the pressure used, the contact surface reactions, for instance, the dissolving speed of SO_2 and NO_2 and oxygen in the liquid phase, play an important part. If we make an extrapolation, it can be shown that we can get in the described apparatus at a pressure of about 25 atm. not less than 10 metric tons of sulphuric acid per cubic meter per day. If the pressure should attain about 33 atm., one could produce per cubic meter per day 17.1 tons of 100 per cent sulphuric acid, showing a volume of acid produced equal to ten times the chamber space. With 50 atm. pressure, we would get about 40 tons or 23 cu.m. of sulphuric acid for every cubic meter of reaction space. It is interesting to compare these figures and the results which we obtained with our experiments with the output of other systems working at normal pressure. This comparison has been made in Table III.

Table II—Production of Sulphuric Acid Under Pressure

Pressure, atmospheres	1.05	6.6	7.0	13.1	13.3	13.5	13.2
Temperature, deg. C	22	21	19	24	70	24	25
Quantity of gas, liters per hr.	17.9	16.3	24.0	65.3	87.6	91.7	100
Nitrogen loss, kg. HNO_3 per 100 kg. H_2SO_4	....	1.0	0.35	....	....	0.81	0.99
Production per cu. m. chamber space per 24 hr., kg. 100 per cent H_2SO_4	154	513	820	3,130	2,920	2,720	3,000

Table III—Performance of Various Sulphuric Acid Systems

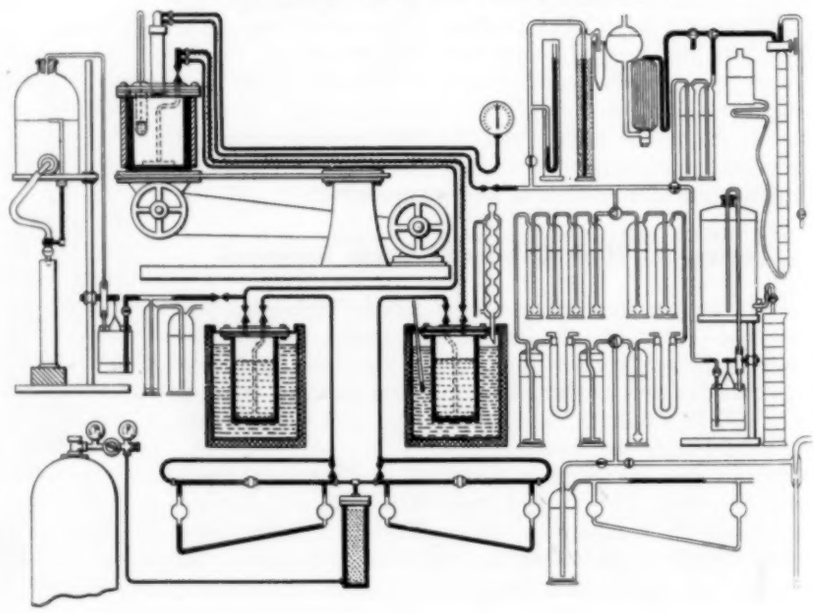
	Production, Kg. 60° Bé. H_2SO_4 per Cu. M. per 24 Hr.	Loss, Kg. 36° Bé. HNO_3 per 100 Kg. H_2SO_4
Older chambers	2–4	1.1
Older intensifying systems with intermediate towers	7.5	....
Newer intensifying systems	10–30	0.75–1.2
Opl towers	30	0.94
Peterson towers	50	0.8
Schmiedel-Klenke roller box	200–300 (?)	....
Pressure synthesis		
13 atm.	3,800	0.9
25.3 atm. (extrapolated)	12,600	....
50 atm. (extrapolated)	50,000	....

The output per cubic meter per day in old chambers was 3 kg. Comparing this with the figure at 25 atm. we can secure at this pressure 4,000 times greater production. At 33 atm. the output would be almost 7,500 times as great and at 50 atm., 16,500 times as great. The pressure synthesis would have the further advantage that the nitrogen losses could be kept at a lower level than when working at normal pressure. The Gay-Lussac tower would be very small if care were taken that Reaction 4*a* or 5*a* should play the chief rôle and Reactions 4*b* and 1 were nearly suppressed.

Problems of Adaptation to Plant

The difficulty which is connected with this pressure reaction lies essentially in the elimination and utilization of the very high reaction heat. If we put our basis on a production of 10 tons per cubic meter per day, more than 5 million kilo calories have to be carried off. With

Fig. 5—Laboratory equipment for pressure synthesis



50 atm. pressure and 40 tons of sulphuric acid production per cubic meter per day, we have to remove not less than 20 million kilo calories, or 80 million B.t.u. It is interesting to note that this heat would be sufficient to concentrate the sulphuric acid produced from 78 to 94% of strength, that is from 60 to 66 deg. Bé. Future investigations will show whether the construction difficulties, which are not very great, may be overcome and whether it will be possible to use the high reaction heat for the concentration of the acid so formed. Inasmuch as the compression costs do not rise in proportion to the pressure, but are relatively lower, working at the higher pressure would be advantageous. It will be seen from Fig. 7 that the cost of energy for higher compression is much less than the increase of production of sulphuric acid by this increased pressure. The waste gases escaping from the small Gay-Lussac tower would have to be expanded. The energy won by the expansion would be used to lessen the compression costs. Unfortunately, one can calculate that only 40 per cent of the energy which is applied to the compression can be recovered in this way.

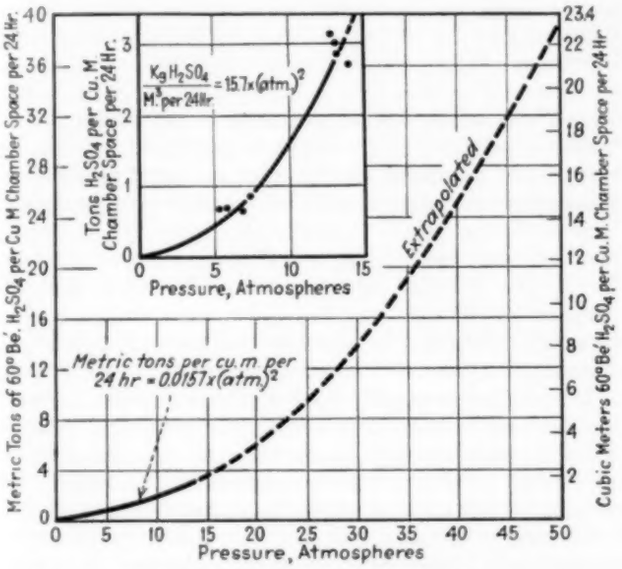

Metric Tons of 60° Bé. H_2SO_4 per Cu M Chamber Space per 24 Hr.
Cubic Meters 60° Bé H_2SO_4 per Cu. M. Chamber Space per 24 Hr.
Pressure, Atmospheres
Tons H_2SO_4 per Cu. M Chamber Space per 24 Hr.
$\frac{Kg\ H_2SO_4}{M^3\ per\ 24\ Hr.} = 15.7x(atm.)^2$
Extrapolated
Metric tons per cu.m. per 24 hr = $0.0157x(atm.)^2$

Fig. 6—Production of sulphuric acid at various pressures

Combination With Ammonia Synthesis Advantageous

Working conditions would be much better if sulphur and oxygen were used, a not unreasonable procedure where the latter is produced as a byproduct, in making hydrogen by the electrolytic process. In countries where the cost of hydro-electric power is very low, such as Norway, one can form the mixture N_2-$3H_2$ for ammonia synthesis by the decomposition of water, forming hydrogen and oxygen. Part of the hydrogen then is used to eliminate the oxygen of air. The remaining oxygen from the decomposition of the water might be used to burn sulphur and to convert SO_2 into H_2SO_4 which with the ammonia produced could form sulphate of ammonia. Under such conditions the expense for compression energy would be relatively small. The whole thing is now an engineering problem which can be solved with the means of today. Technical difficulties would arise, however, in the utilization of the reaction heat in order that the dilute sulphuric acid could be concentrated to 66 deg. Bé.

The results of our latest investigations have been treated here in a rather superficial way. They show that the theory developed many years ago has stood the test of a recent thorough examination.

In the course of our experiments we have synthesized nitrosylsulphuric acid and we have found that it is a real nitroso compound.

We have made a thorough study of the violet acid and we have been the first to get this very interesting substance in a highly concentrated state. We determined in a very accurate way the vapor tension of the solutions of nitrosylsulphuric acid in sulphuric acid of different strengths and temperatures in, and without, the presence of nitric acid. We have fixed the sources of losses of the valuable nitrogen compounds. We have shown that it is possible to draw from more theoretical deductions interesting technical results. Whether engineers designing tomorrow's acid plants will follow our suggestions, the future will show.

Past and Future Progress

Considerable progress was made in the field of contact oleum because of the introduction of poison-resisting vanadium catalyzers. Similar progress is possible in the lead-chamber process by introducing pressure synthesis which, when applied, would result in the production of sulphuric acid of strengths up to 66 deg. Bé. at lowered operating cost. The author believes that the process of the future will be a combination of the pressure lead chamber process and the contact process. In the future one will add to the last tower of the oleum absorption system cheaply produced lead chamber acid, made according to the pressure process.

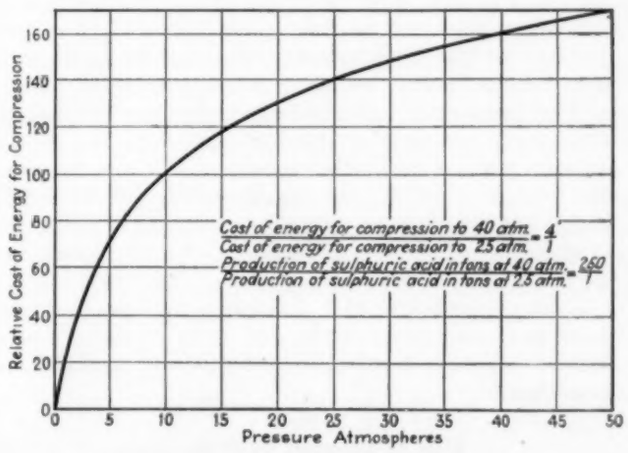

Relative Cost of Energy for Compression
Pressure Atmospheres
Cost of energy for compression to 40 atm. / Cost of energy for compression to 2.5 atm. = 4/1
Production of sulphuric acid in tons at 40 atm. / Production of sulphuric acid in tons at 2.5 atm. = 260/1

Fig. 7—Relative cost of compression energy for various pressures

Our experiments and the theoretical ideas have thrown some light on one of the oldest and most important technical reactions. It is of some importance that a process known for so long a time should have been explained to a certain degree. The last word, however, has not yet been said.

Alcohols of Industry

By E. W. REID

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A BRIEF SURVEY of the aliphatic alcohols reveals that a rather startling number are produced on a commercial scale. Disregarding the keto alcohols, the alcohol ethers, the aldehyde alcohols, and the higher ones, such as cetyl and lauryl, there are 23 aliphatic alcohols that may be purchased in drum and carload quantities. Production of the majority of these is a recent development. Prior to 1918, the only alcohols available to industry were methyl, ethyl, a mixture of the amyls (usually sold as fusel oil), and glycerol. However, utilization of butanol in the lacquer industry and the rapid expansion of the latter stimulated interest in other alcohols. As the ethyl, butyl, and amyls were produced by fermentation or were byproducts of this method, this source was investigated thoroughly for other alcohols, but with little success. The chemical literature contained considerable information on the synthesis of a large number of alcohols but such methods were believed impractical and of little commercial importance. However, thorough investigation of methods of synthesizing these products has resulted, within the past decade, in their commercial production. At present all of the 23 alcohols mentioned are, or can be, produced synthetically at low costs. These methods can compete favorably with the older processes of the better known and more widely used alcohols. The possible exception is glycerol, a byproduct of the soap industry, the cost of which in the dilute form is more or less a matter of bookkeeping.

The number of alcohols that can be synthesized is quite large and their production awaits only the demands of the chemical and allied industries. If the isomers of the normal alcohols are considered in future development, the possibilities assume astronomical proportions. The calculated number of isomers of octyl alcohol is 89, of a C_{10} alcohol 507, of a C_{20} over 5,000,000, and of a C_{30} over 95,000,000,000. Undoubtedly very few would have any commercial value, but some of those now unknown will have important industrial applications in the near future.

Use of Ethanol Will Decrease

The alcohols are the most important industrial organic chemicals from the standpoint of tonnage, volume, and diversity of applications. As practically all natural fermentation processes give ethanol, this was the first alcohol of industrial importance. In spite of all the restrictions placed upon it, ethanol occupies a place of major importance in our industrial life. It appears probable that its use will decrease due to the competition of methanol and isopropanol which, in many applications, may be substituted at an equivalent cost and may be used without restriction. The characteristic odor formerly associated with methanol is not present in the synthetic product. The uniform purity of this alcohol has greatly increased its use and, in many applications, it is substituted for ethanol. The most commonly used "characteristic odor" method of identifying organic chemicals has required a radical revision in recent years due to the elimination of certain impurities generally accepted as characteristic but not present in the purified material. Efficient production methods, coupled with properly designed and operated equipment, has resulted in practically chemically pure alcohols at costs formerly not attained with a semi-crude or commercial product. Some alcohols are sold as mixtures of isomers or mixed with other products, but the composition is known and is uniform. A good example is synthetic methyl acetone, a mixture of 50 per cent acetone, 25 per cent methyl acetate, and 25 per cent methanol; whereas the former product was an intermediate distillation cut of varying and usually unknown composition.

Solvent Power of Alcohols

In general, the solvent power of the normal alcohols decreases with increasing molecular weight. With the possible exception of isopropanol, the secondary alcohols are not as good solvents as the normal, and the tertiary have generally poor solvent properties. The polyhydric alcohols are rather poor solvents and are only used where their low vapor pressure, hydroscopicity, or other properties make them desirable.

The boiling points of the normal monohydric alcohols increase progressively with molecular weight, the rise being approximately 20 deg. C. for each CH_2 addition. The primary alcohols boil higher than the isomeric secondary, and the latter higher than the tertiary. The specific gravity of the normal alcohols increases slightly with molecular weight, this increase approximating 0.006 from even to odd numbers of carbon atoms, and 0.0048 from odd to even on values obtained at 20 deg./20 deg. C. The specific gravities of the secondary alcohols are generally lower than those of the primary, and the tertiary lower than for the secondary, but these values increase with the molecular weight. The water solubility decreases as the molecular weight increases, but increases with the accumulation of methyl groups in the secondary and tertiary. The specific heat increases with each CH_2 addition, while the latent heat of evaporation decreases. The secondary and tertiary isomers show the same tendency. The dihydric alcohols do not exhibit the same regularity in their physical values as the monohydric.

Based on a paper presented before the American Institute of Chemical Engineers at the Pittsburgh meeting, Nov. 15.

At present, the series is quite short and it is possible that observations on a larger number would indicate some regularity. The polyhydric alcohols have considerably higher boiling points and specific gravities than the monohydric and are all water-soluble and hydroscopic.

The alcohols represent the major tonnage of the solvent industry, accounting for about 800,000,000 lb. of the total of slightly over 1,000,000,000. This large market naturally stimulates interest in this field, resulting in rather extensive investigation of the numerous alcohols not produced on a commercial scale. The competition of the alcohols for industrial applications has extended their use and, in some cases, increased the demand for the older products and thus enlarged the total market. At present, one or more of the alcohols are used in practically every industry, and as a group, they may be considered the keystone of our industrial life.

Toxicity of Alcohols

The preferential industrial use of the alcohols is due to their excellent solvent power, their low cost, and low toxicity. The latter is of major importance where large volumes are handled. While all alcohols are toxic when taken internally, their vapors offer little industrial hazard with sufficient ventilation to prevent their accumulation in high concentration. All organic chemicals are toxic to some degree but their effect depends entirely upon concentration and length and frequency of exposure. Methanol is less toxic than ethanol in a single dose or exposure, but its effect is cumulative; consequently, it requires greater care in handling. With the possible exception of isopropanol, the secondary and tertiary alcohols are more toxic than the primary. In general, the industrial hazard of the alcohols is largely a function of their vapor pressure. Although the toxicity increases with the molecular weight, the vapor pressure markedly decreases, which tends to decrease the hazard at equivalent temperatures. The polyhydric alcohols have low vapor pressures and low toxicity and do not require special precautions in handling. Glycerol and propylene glycol are used in food products and show no toxic effects when used in small quantities.

The largest single use of the alcohols is as antifreeze. Ethyl alcohol was first used and has maintained the major share of this market. Methanol, isopropanol, and mixtures of these alcohols are now offering rather keen competition for this use. Ethylene glycol and glycerol have also found a ready sale as antifreeze, for which they have sufficient merit to warrant higher price. About 45,000,000 gal. of alcohols was sold last year as antifreeze material. Practically all antifreeze alcohols will, in the future, contain an inhibitor to prevent corrosion of the cooling system. There is a strong tendency on the part of the automobile owner to blame the antifreeze for any trouble in his cooling system. As neither he nor the mechanic knows that water is much more corrosive than the alcohols it is difficult to convince him that his trouble is primarily due to rusting by water. Use of inhibitors will overcome the difficulties to some extent, as some of the inhibitor will remain in the system after the alcohol has evaporated or been removed. Development of the high-temperature cooled motors for automobiles will radically change this market, since the low-boiling alcohols cannot be used. This type of motor has been quite successful in air-planes and is receiving considerable attention in the automotive field.

The surface coating industry is a very large outlet for the alcohols. While the alcohols, as such, comprise less than 10 per cent of the total solvents used, their esters represent the major portion of the active cellulose ester solvents. The high-boiling alcohols and their esters are used almost exclusively in the slow-drying lacquers and the nitrocellulose type of printing inks. The majority of plasticisers used in lacquers are the ester type of very low vapor pressure. The alcohols are not solvents for nitrocellulose but are classed as latent solvents, i. e., they become solvents in the presence of esters. As a result, most of the esters sold to the lacquer industry contain 10 to 15 per cent of the corresponding alcohol. There are many other applications for the alcohols in the preparation of nitrocellulose products, such as pyroxylin plas-

Physical Properties of Aliphatic Alcohols

Alcohol	Formula	Molecular Weight	B.P. °C.	Sp. Gr. 20/20	Sp. Heat	Latent Heat of Evap. Cal./Gm.	Solubility In Water % by Volume	Solubility Water In % by Volume
Methyl	CH_3OH	32.03	64.5	.7928	.33 (77°)	263	Complete	
Ethyl	CH_3CH_2OH	46.05	78.5	.7907	.581 (25°)	204	Complete	
N-Propyl	$CH_3CH_2CH_2OH$	60.6	97.3	.8060	.648 (50°)	164	Complete	
Iso-Propyl	$(CH_3)_2CHOH$	.....	82.3	.7863	.677 (80°)	159	Complete	
N-Butyl	$CH_3(CH_2)_2CH_2OH$	74.08	117.9	.8108	.562 (100°)	141	8.0 (20°)	19.5
Iso-Butyl	$(CH_3)_2CHCH_2OH$	.....	107.9	.8020	.603 (50°)	138	10.0 (25°)	16.9
Sec.-Butyl	$CH_3CH_2CHOHCH_3$	.....	99.5	.8080	.650 (25°)	134	12.5 (20°)	44.11 (25°)
Tert.-Butyl	$(CH_3)_3COH$	.....	82.4	.7860	.722 (25°)	130	Complete	
N-Amyl	$CH_3(CH_2)_3CH_2OH$	88.09	137.9	.8170	.771 (51°)	120	2.7 (25°)	9.3
Sec.-Amyl	$CH_3CHOHC_3H_7$	.....	119.5	.8090	.535 (20°)	28	4.2 (20°)	10.4 (28°)
Tert.-Amyl	$(CH_3)_2COHC_2H_5$	.....	101.8	.8090	.752 (50°)	106	12.5 (25°)	25.7
N-Hexyl	$CH_3(CH_2)_4CH_2OH$	102.11	156.8	.8217	.545 (25°)	122	.59 (20°)	6.4
2-Ethyl butyl	$C_2H_5CH(C_2H_5)CH_2OH$	.....	148.9	.8328	.586 (25°)	109	.63 (20°)	4.56
Methyl amyl	$(CH_3)_2CHCH_2CHOHCH_3$	.....	131.4	.8072	.654 (25°)	102	1.73 (20°)	6.37
2-Ethyl hexyl	$CH_3(CH_2)_3CH(C_2H_5)CH_2OH$	130.14	184.6	.8344	.564 (25°)	93	.06 (20°)	2.48
Sec.-Octyl	$CH_3(CH_2)_5CHOHCH_3$	.....	178.5	.8193	.607 (25°)	84	.095(20°)	4.2
Allyl	$CH_2=CHCH_2OH$	58.05	97.0	.855	.665 (60°)	163	Complete	
Ethylene glycol	$C_2H_4(OH)_2$	62.05	197.2	1.1155	.575 (20°)	2.0	Complete	
Di-ethylene glycol	$HOCH_2CH_2OCH_2CH_2OH$	106.08	244.5	1.1185	.55[1] (20°)	150	Complete	
Tri-ethylene glycol	$HOCH_2(CH_2OCH_2)_2CH_2OH$	150.1	288.0	1.1254	.525 (25°)	100	Complete	
Propylene glycol	$CH_3CHOHCH_2OH$	76.06	187.4	1.0381	.590 (20°)	168	Complete	
Di-propylene glycol	$CH_3CHOHCH_2OCH_2CHOHCH_3$	132.09	231.0	1.0236	.568 (20°)	171	Complete	
Glycerol	$CH_2OHCHOHCH_2OH$	92.06	290.0	1.260	.668 (100°)	62.6	Complete	

tics, collodion, artificial leather, smokeless powder, and the like. It is necessary to keep nitrocellulose dampened with alcohol when it is transported or stored. Ethanol is normally used for this purpose except for export, when isopropanol is substituted to escape the high duty on ethanol imposed by most foreign countries.

Applications

Ethanol, as well as mixtures of ethanol, methanol, and/or isopropanol, is used for cutting shellac. Where slower evaporating solvents are required alcohol-ether solvents are used rather than the higher alcohols. Dewaxing of dammar and solution of a number of resins and gums require an alcohol. The polyhydric alcohols are components of the polymerised ester type of resins used extensively in varnishes and lacquers. Methanol is used for the manufacture of formaldehyde, a necessary constituent of several of the better known resins, such as phenol-formaldehyde and urea-formaldehyde resins. The non-aqueous wood stains are usually solutions of a dye in two or more alcohols and an alcohol ether. Among numerous other smaller applications in the surface coating industry are cleaning, pigment dispersion, solvent couplers, and the like.

The cosmetic industry, the third largest outlet for alcohols, is a market very little affected by business depressions. Ethanol, isopropanol, glycerol, glycols, and glycol ethers are used almost universally in the various cosmetic preparations. Ethanol was formerly used almost exclusively but isopropanol is now being substituted for it quite extensively. The antiseptic and germicidal value of isopropanol is slightly better than that of ethanol in dilute solutions, while its solvent power for such ingredients as the essential oils is equivalent and it does not require a permit for its uses. Glycols and glycerol are constituents of various facial creams, hair-waving compounds, and hand lotions. While ethanol is the major solvent component of perfumes the use of isopropanol is also increasing. Many of the esters, ketones, and aldehydes of the alcohols are necessary ingredients in perfume blends.

The alcohols are used in the preparation of numerous medicinal products. The extraction, purification, and dehydration of many preparations and the synthesis of others require the use of one or more alcohols. A large number of medicinals that are administered in solution are dissolved in one or a mixture of alcohols.

Textile Industry Is an Expanding Market

The textile industry is an expanding market for the alcohols. The polyhydric alcohols are used for conditioning fibers and yarn to maintain a definite moisture content, as lubricants, or constituents of lubricants. Preparation of many oil emulsions require the use of an alcohol as a coupling agent or penetrant. The higher monohydric alcohols, especially the hexyl and octyl, are used as antifoam agents and the sodium sulphonate of the octyl as a penetrant and introfier. Practically all the alcohols have some application in dyes, as solvents, in the synthesis or preparation of various dyes, and in dye pastes. The use of the sodium sulphonates or sulphates of the higher alcohols as detergents and penetrants is now receiving considerable attention and a rapid commercial development of these alcohols is likely to take place. Some of the alcohols, especially ethanol and isopropanol, are used in the manufacture of transparent and liquid soaps and soap tinctures.

The chemical industry is quite dependent upon the alcohols as solvents, for purification, extraction, and in crystallization processes. Ethanol has been used to the greatest extent, but the other alcohols are gradually replacing it. The alcohols are used in the preparation of a large number of esters, and either directly or as an intermediate to introduce their characteristic alkyl group. They are readily esterified with organic or inorganic acids to the corresponding esters. The monohydric, in particular, form constant boiling binary and tertiary mixtures. The primary alcohols are easily oxidized to the corresponding aldehydes and acids, the secondary alcohols to the ketones, while the tertiary alcohols are decomposed by this treatment. The dihydric alcohols are readily esterified to the corresponding mono and di-esters and glycerol to the tri-esters. In general, the mono-esters are formed quite readily and the additional ester groups with more difficulty. As a rule, the polyhydric alcohols react as the primary monohydric on the first hydroxyl, but less readily on the additional hydroxyls. All the alcohols react with the aldehydes in the presence of a mineral acid whereby the acetals are formed.

Chemical Industry Depends Upon Alcohols

The food and beverage industries utilize ethanol, glycerol, and propylene glycol as solvents for the essential oils and coloring materials used in flavoring extracts, syrups, as mold inhibitors, and other products. These alcohols are the only ones that are generally approved for food products, although others are sometimes used against the recommendation of the manufacturer. Propylene glycol and glycerol are also used as lubricants in pumps employed in the transfer of liquid or semi-liquid food products or beverages. Propylene glycol, or its solutions, is used in beer coolers as the cooling medium or brine and as a lubricant for beer pumps.

Allyl is the only unsaturated aliphatic alcohol available in quantities larger than laboratory samples. Its pungent odor prevents its use as a solvent; consequently, its commercial value is as an intermediate in the preparation of other materials. The double bond changes its chemical activity to some extent and it does not always follow the normal alcohol reactions.

In general, the alcohols are considered to have no action on the common metals. They react, however, with lead, aluminum, magnesium, and similar metals to form the alcoholates. The metallic salts of the alcohols are used extensively in chemical synthesis.

Introduction of a new alcohol is usually followed by a large number of its derivatives. This is the basis for the statement that the alcohols are the foundation of our aliphatic organic chemical industry. Within the next few years a number of new alcohols will undoubtedly be produced on a commercial scale and at comparatively low prices. New synthetic methods and improvements in the older processes, coupled with the demands of industry, stimulate the development of new alcohols and new solvents.

Inductive Electric Heating in Chemical Production

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THE INDUCTIVE ELECTRIC GENERATION of heat in ferromagnetic materials has been a familiar phenomenon throughout the past century, but no great attention was given the matter until the development of alternating current and its use in iron cored coils became seriously hindered by the heating effects. Subsequent study and investigation of the problem led to ways and means of reducing this conversion of energy but no utilization of it was made until Kjellin installed his first ring type induction furnace for melting metals in 1900. In 1917 Dr. E. F. Northrup installed the first practical induction furnace using frequencies higher than normal and this was the beginning of that branch of the art employing high frequencies.

Much of the credit for rapid and successful advancement in this line is due the Ajax Electrothermic Corp. of Trenton, N. J., and it seems highly probable that the process industries may, in turn, be able to thank this same organization for development of the low frequency, moderate temperature branch of the art so peculiarly fitted to its needs.

For the benefit of those having no occasion to follow this branch of electrical science it is pointed out that inductive electric heating seems to have found a natural division into two, well defined branches, namely: High-frequency types for high temperatures, Commercial frequency types for moderate temperatures.

The intent of this paper is to briefly treat of both theory and application of this latter, less familiar type with hope that much of the uncertainty and misconception so prevalent regarding it will be clarified.

The term "commercial frequency" is offered as a distinguishing name for this branch of inductive heating since it will rarely find application under any other than the 25 and 60 cycle frequencies of commercial power lines. This implies that no frequency changers are needed and therein lies the essential difference from a cost of equipment standpoint.

Like all other man-made appliances commercial frequency inductive heaters have their limitations and disadvantages as well as their points of merit. Unless corrected by condensive equipment they congest the power feed lines with out-of-phase currents necessitating larger conductors than normal and they are applicable only to iron, steel and nickel apparatus, but their advantages in certain respects are so pronounced that they are gaining recognition steadily.

The essential parts of a typical inductive heater, applicable to process equipment, are shown by Fig. 1. K is the vessel to be heated and may be of any size, shape or thickness of wall. It must be fabricated of ferromagnetic material, however, or there will be no concentration of magnetic flux within itself and, therefore, little heat generation. This part is the core of the electromagnet.

C is the alternating current conductor wound in helical form to develop an intense magnetic field within its turns and the enclosed core. This conductor must be of low ohmic resistance, as copper or aluminum, and may be of wire, bus bar or tubing. The latter is preferable on high-temperature installations as it permits of cooling the coil by running water through the bore. Low-temperature heaters will require nothing more elaborate than asbestos insulated wire and, on small diameter cores, this wire may be wrapped directly onto the thermal insulation. Such construction gives a smaller air gap loss but complicates fabrication and increases the difficulty of future alterations.

As will be shown later, the only way to alter the heating effect of a coil, once it is in place, is to change the number of turns in circuit and this is done by "tapping" or making terminal connections at any desired point on a turn. Obviously such work would be facilitated by spaced turns of bare conductor. When coils are wound on piping it is generally more convenient to use flanged sections which can be moved into position after the winding operation. Large diameter coils carrying heavy current are subject to both radial and axial forces of considerable magnitude so that a cradle or substantial winding form of some kind is essential.

I is the thermal insulation of any type to lessen radiation loss from the core and has no bearing on the inductive features other than to increase magnetic flux loss by reason of the non-magnetic space created by its presence. The use of electric conductive materials must be avoided in attaching this insulation to the apparatus as any circuits even approximately parallel to the turns of the coil will be subject to heavy secondary currents of a damaging nature.

Connection from the coil terminals to power line is made by means of adequate oil immersed switches with no resistance, starter or other auxiliary in circuit so that the foregoing parts are all that are needed in an inductive unit. Power factor corrective devices and thermostatic controls are desirable refinements but not essential and the same may be said of a multiplicity of control switches for heat regulation. Practical operation demonstrates that two switches, one for low heat or all of the

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coil turns and one for high heat, with about .8 of the turns in circuit, are sufficient.

Discussion of the technical features involved in an inductive heater of this type will give a better understanding of the possibilities and limitations and, at the same time, give warning that for all its simplicity of outward appearance the mechanism involves and is governed by all the complex laws of magnetic and electromagnetic phenomena.

When metals possessing ferromagnetic properties are placed in the path of an alternating magnetic field the phenomenon of flux concentration transpires leading to induction densities in the metals which are unattainable in any other medium. This is read in the familiar equation, $B = \mu H$. When the permeability, μ, is low as, for instance, 1 in air, H, the magnetic intensity, has to be exceedingly strong to give to the induction, B, a value sufficient for pronounced heating phenomena. Where permeability is of high order, however, as in iron or steel, the product of its value times the magnetic intensity H, which latter is 1.257 times the ampere turns per unit length of coil, leads to values of B which are appropriate for heating work.

It may be of interest to note that at just this point is to be found the fundamental difference between high-frequency, coreless heating and commercial frequency applied to cored heaters. In the former there is generally no ferromagnetic core of a permanent nature and it becomes necessary to augment the phenomenon with greater cyclic rapidity or high frequency.

Later on it will be shown that heating effects are proportional to induction density therefore this concentration of magnetic flux in highly permeable metal is of greatest importance. Also, since induction density in the core is the difference between total coil flux and that portion traversing the air space between coil and core, called leakage flux, it is important to maintain the tightest possible linkage.

Separation of the coil and core wall for installation of the thermal insulating material causes a distinct electrical loss and has to be justified by the advantages of lower temperature and less ohmic resistance of the coil together with retention of heat within the vessel.

HYSTERESIS—Cyclic magnetization of ferric materials results in internal molecular friction which evidences itself as heat of the mass. Such transformation of energy is expressed by the equation:

$$\text{B.t.u. per hr.} = f \times V \times B^{1.6} \times k \times 3.42 \times 10^{-7} \quad (1)$$

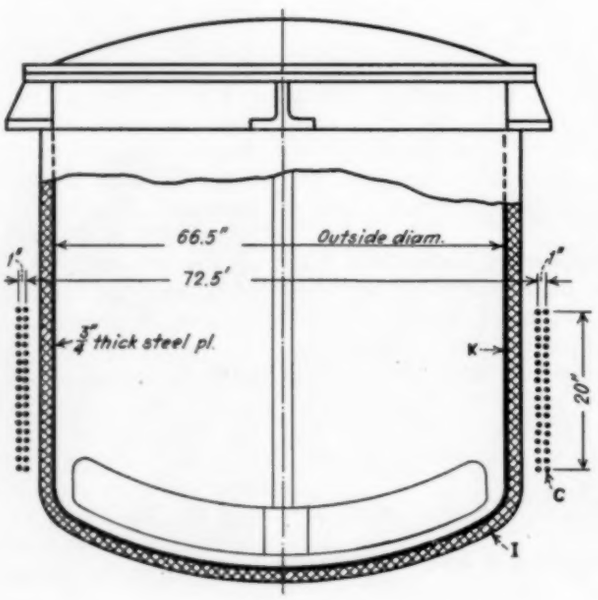
where,
- f = cycles per second
- V = cubic centimeters of core material traversed by the flux
- k = hysteretic constant, evaluating empirically all the chemical and physical characteristics of the metal
- B = maximum induction density in gases

Frequency values in the above equation will be 25 or 60 under normal conditions. Volume V will be determined by the active length of the coil times the area of an annulus whose large diameter is the outside diameter of the core and whose radial width is the effective depth of penetration. The hysteretic constant is fixed, as an attribute of the metal being used, and will be of the order of 0.003 for sheet steel and 0.018 for cast iron. It is thus seen that hysteretic heat generation is augmented by higher frequencies and varies directly as the 1.6 power of the induction density.

EDDY CURRENTS—Cyclic reversals of a magnetic flux within a mass of conductive metal induce currents in countless minute circuits whose existence is attributed to differences in the induced voltages. Ohmic resistance to these currents results in further heat generation which is expressed by the equation:

$$\text{B.t.u. per hr.} = f^2 \times V \times B^2 \times e \times c \times 3.42 \times 10^{-7} \quad (2)$$

where,
- f = cycles per second
- V = cu.cm. of core material traversed by the flux (as in Eq. 1)
- e = eddy current factor evaluating physical features of the core material and usually of the order 0.001
- c = electrical conductivity of the core metal
- B = maximum induction density



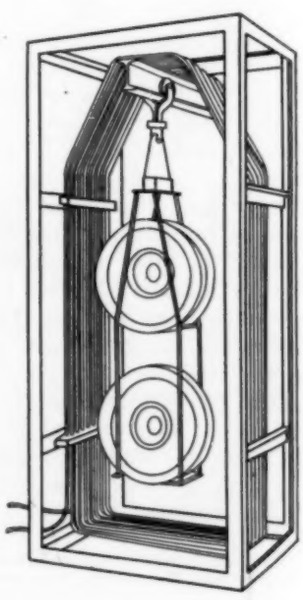


Fig. 1—Typical arrangement of an inductively heated vessel.

Fig. 2—One unit of a series in tunnel form and through which a continuous conveyor transports painted objects. Inductive phenomena establish hysteretic and eddy current action in the metal of the parts sufficient to promote rapid drying.

Fig. 3—60 cycle twin kettles. Coils wound on heavy bars cast integral with and connecting two kettles, thus forming a toroidal ring. Magnetic flux follows circuit formed by two bars and side walls of kettles setting up hysteretic and eddy current action but does not develop mutually induced secondary currents of any magnitude. In such an arrangement there is no flux loss since the magnetic circuit lies wholly within the coil turns and no air gap reluctance is created

Here, as in equation 1, all factors except induction density are fixed and heating will vary as the square of this density.

MUTUALLY INDUCED CURRENTS—The combination of coil and concentric core in the inductive heater acts as a transformer and true secondary currents are induced following the inverse ratio laws so that, with one turn in the secondary, that is, the core itself, the resulting current therein will equal the product of the coil current times its number of turns. Disregarding, for the moment, the inefficiency of coupling between the coil and the core heat generation in the latter would be expressed by the equation,

$$\text{B.t.u. per hr.} = 3.42 \times I^2R \qquad (3)$$

in which R is the ohmic resistance of that area of core metal conducting the induced current I.

Owing to the heavy secondary currents generated within the core metal the greatest portion of heat is gained from this source, but, in the interests of efficiency, the heat from hysteresis and eddy current action is not to be disregarded. Many factors enter into the make-up of the hysteretic and eddy current constants, k and e, of equations (1) and (2) which have pronounced bearing upon the amount of heat realized from these sources. Investigations have shown that k ranges from 0.0004 for electrolytic iron to 0.08 for glass hard steel, a difference of 200, due, apparently, to the hardness of the metal. Practical experiments show that a somewhat similar range exists in cast irons, the chilled metals giving much greater heat generation and tests on rolled steel show a 5 per cent increase in total heat generated by hysteresis and eddy currents when the magnetic flux is directed normal rather than parallel to the direction of rolling. It has been observed that coarse grained cast irons develop greater eddy current heating than the finer grades and other factors, such as carbon content, alloying and aging all have pronounced effect upon heat generation so that the designer of such installations has some small latitude unless the equipment to be heated has already been fabricated.

The foregoing expressions of heat generation are based on the assumption of full utilization of the total coil flux so that the results obtained must be modified by some factor which evaluates loss of flux due to the incomplete linkage of actual conditions. Without a magnetic core in the coil the flux developed by the latter would spread uniformly over the whole area enclosed by the turns. Insertion of a ferromagnetic material in this field leads to an accumulation of flux therein amounting to such portion as is intercepted plus an added amount drawn from the regions of the coil and not intercepted by the body. The ratio of flux entering the core to the total flux of the coil may be expressed by the equation,

$$F = \frac{\text{core diameter}^2}{\text{coil diameter}^2} \times C$$

where C is a constant of design ranging from 1.0 to 1.3 depending upon the space between coil and core surface. In any case F can never be greater than unity, that is, where the coil is wrapped directly on the core and the two diameters are equal.

In calculations involving the areas and volumes of core material traversed by the magnetic flux, as in equations 1 and 2, account must be taken of the limitations regulating the depth to which an alternating flux can penetrate any mass of magnetic material. The effective depth of penetration attained under the foregoing conditions is expressed by the equation,

$$D = \frac{5030}{\sqrt{f \times \mu \times \lambda}} \text{ centimeters where,}$$

f = cycles per sec.
μ = permeability
λ = conductivity

Below are tabulated some values of D at 25 and 60 cycles for materials commonly used in equipment building.

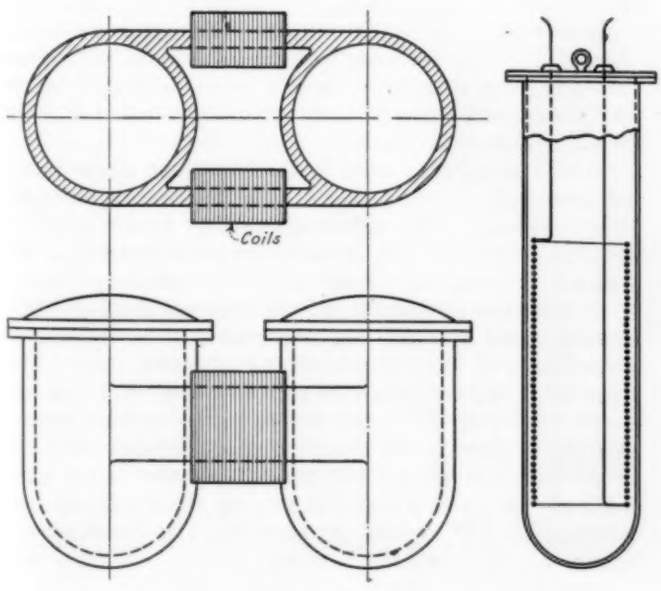
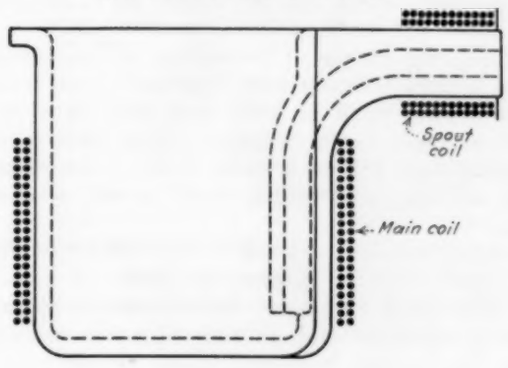


Fig. 5 (left)—An inductive finger heater used where high temperatures are not needed. Coil is wound for insertion in a cast or wrought pipe and arranged for a vessel which can be heated inductively. Tube may be coated where conditions are corrosive
Fig. 6 (below)—An application of auxiliary induction coil in conjunction with a main coil. Turns around spout near outer end maintain sufficient temperature to prevent freezing at this point



Frequency			25	60
Soft steel,	$\mu = 1000$,	$\lambda = 10^5$	0.100	0.064
Cast iron	$\mu = 200$,	$\lambda = 10^4$	0.700	0.460
Copper	$\mu = 1$,	$\lambda = 10^5 \times 6$	1.300	0.838

Where the inductance coil is to be applied to a vessel for the purpose of heating the contents a calculation of heat requirements for the process plus some additional amount for radiation losses will give a total which must be attained by the heat generation as indicated in equations 1, 2 and 3. Several trial calculations will be in order starting with an assumed value of B, the maximum induction density to which the core will be subjected, and solving for heat units under different conditions of coil length. The latter will have to be coordinated with the depth of penetration to arrive at the volume of metal involved.

Determination of an acceptable value for the induction density will lead, through the equation $B = H$, to the proper value of H, the intensity of magnetization, to be used. The latter is usually expressed in terms of ampere turns per unit length of coil by the equation,

$$H = 1.257 \times \frac{N I}{1}$$

where 1 is the axial length of coil and N and I are the number of turns and amperage respectively.

Values for permeability, in the absence of specific data for the material at hand, must be selected from $B - H$ curves of irons or steels most closely resembling those of the contemplated installation. In passing from magnetic intensity to ampere turns the coupling or leakage factor must be employed and the resultant ampere turns per unit length of coil, $\frac{N\ 1}{1}$, must be increased to give the added intensity required to counteract flux losses of the air gaps. Ampere turns per unit length may now be resolved into number of turns and amperage by a few trial calculations. As the coil turn spacing will be governed by the policy of keeping turns as tight as possible, consistent with cooling and constructional demands, the turns per unit length value will practically solve itself and the actual number of turns to permit passage of the proper current must then be determined.

Experience has shown that the expected power factor of inductive units varies from 0.52 to 0.56 for fairly close coils of a uniform circular section. The use of capacity condensive equipment in circuit with the coil will effect a partial or complete neutralization of the heavy, lagging currents and correct the power factor in most cases to 0.80 or better. This is an electrical refinement, however, which has no effect upon the heater itself.

The foregoing outline of procedure for calculation of inductive heaters indicates how dependent upon assumptions the results must be and, until such time as the inductive designer has a literature of his own, most of the working data will be a compromise of the negative findings of the transformer and power machinery builders.

A practical solution of some of the difficulties lies in the fact that coils, for process equipment at least, are more or less fixed in general dimensions by the apparatus being equipped and, relying upon the unvarying law that the current in a coil varies inversely as the square of the number of turns, a fairly liberal length may be provided initially with taps or connections for reducing the number of turns in circuit as the needs develop. Decreasing the number of turns increases the heating effect so no additional construction will be needed to alter the capacity providing the size of conductors has been selected with such possibilities in mind. Illustrative of this adaptability is the case of a certain storage tank which had been wound with a 50 turn coil and which gradually became fouled inside with sludge and sediment thereby reducing the heat transfer. As this condition progressed the number of turns were gradually reduced to 25 and the desired temperature maintained until cleaning could be arranged. This procedure has been in practice for several years and the tank is still as good as new, an interesting contrast to the heavy maintenance expense which would have resulted from the use of open flame heating under similar conditions.

Since the heat generated by inductive phenomena has seat within the molecular structure of the mass being heated it follows that there are some distinctive advantages in the system. In the case of autoclaves, kettles or other vessels used for processing flammable liquids the fire hazard, so omnipresent with open flame or resistance heat sources, is entirely eliminated. Even though the coil is of bare conductor the difference in potential between neighboring turns is insufficient to cause sparking in the event the product spills. Again, the distribution of heat is uniform around the vessel walls and there can be no local overheating even though internal agitation is lacking.

Advantages in System

It is true that heat generation is greatest at the midsection of the coil but this can not result in damaging temperatures owing to the fact that hysteretic and eddy current phenomena cease around the critical temperature of 800 deg. C. and any local spots attaining such temperature would automatically stop functioning without affecting the remainder of the circuit. Should the whole mass of the vessel or core approach the critical temperature the cessation of eddy current phenomenon and its attending screening effect will release the entire area of vessel wall to conductance of the heavy secondary current thereby slowing up the heat generation from this source. These features become of prime importance when heating sluggish materials or in processes involving heavy wall incrustations where heat transfer to the vessel contents is erratic.

Where apparatus, used in batch process work, has to be cooled this type of heater with its absence of heavy, heat retaining walls offers interesting possibilities, especially so if provision is made for some forced air circulation between the vessel wall and insulating cover.

As a matter of interest, the dimensional data of Fig. 1 are appended to show the proportions of an inductively heated unit in daily operation at a chemical plant. This equipment, wound with a 38 turn two-layer coil, operates under 440 volt, 60 cycle, single phase current with a starting or heating-up input of approximately 180 kva. at 55 per cent power factor. The power input automatically drops to about 126 kva. as the operating temperature of 450 deg. C is reached. The installation is typical of batch process requirements.

Admixtures Improve Properties of Sulphur Cements

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SULPHUR as such or in various combinations, particularly as sulphur cements, has been used as a sealing compound or bonding agent for many years. Although such cements have been known for a long time, the technical literature[1, 25, 28] reveals but little information regarding their physical characteristics and utility. In the present paper these data will be presented; and, in addition, there will be given a description of a comprehensive research that had for its aim the development of a new type of sulphur cements, evolved primarily for the purpose of satisfying a wide range of industrial requirements.

At first, because of its inertness, ease of application and strength, sulphur was probably used *per se*, particularly as a bonding material. It was employed to set iron hand rails in stone. Holley[15] notes an instance in which a generator engine at a mine had become loose in its base. It was impossible to shut down the works and make extensive repairs. So the engine was jacked up, the foundation cleaned with air, a shallow trench dug in the concrete engine bed and the trench filled with molten sulphur. When the sulphur had cooled, the engine was started and, with such anchorage, operated satisfactorily for more than three years. At present acid pickling tanks, constructed entirely of sulphur, are giving excellent service.

Although sulphur can be used as such, its strength as a bonding agent can be increased by the admixture of coal,[2] sand,[24] pumice,[6] and other materials[11, 14, 17, 31]. Peculiar characteristics can be imparted to it by the addition of bitumens[4, 7, 8, 9, 16, 29, 33], metallic sulphides[20, 22, 27, 30], and fibrous materials[21, 32]. In some instances iron filings[3, 13] and ammonium chloride[5] have been added to sulphur, particularly for use in joining iron pipes. These last cements owe their strength not only to the action of the sulphur itself but also to formation of iron sulphide.

While certain of these products had been known for years, it was not until the work of Bacon and Davis[1] was reported that attention was directed to the fact that sulphur cements can be used in the chemical industry because of their acid-resistant properties. These authors showed that cements of excellent strength could be made by mixing 40 per cent by weight of sulphur with 60 per cent of sand. The publication of their data no doubt led to the fabrication and utilization of such cements in many manufacturing establishments. Since that time the design of these cements has changed and more attention has been given to the type and grading[18, 23] of the aggregate used in their production. The manufacture and sale of these cements have been undertaken by several companies that have developed excellent products. The use of these cements in joining cast-iron water mains of the bell and spigot type has been described by Robinson[26]. Fritz[10] has reported the protection of rubber-lined steel, as developed by the B. F. Goodrich Co. and used in the construction of pickling tanks, with a brick sheathing laid up in a sulphur cement. These commercial cements contain approximately 54 per cent of sulphur by weight. The type of aggregate used in their fabrication varies and may be determined by the kind of material available in the districts in which the cements are prepared. It may consist of sand, crushed porcelain, or shale. The tensile strength of such cements may vary from 480 to 648 lb. per sq. in., their modulus of rupture from 1,558 to 2,050 lb. per sq. in., and their coefficient of expansion from 31×10^{-6} to 48×10^{-6}.

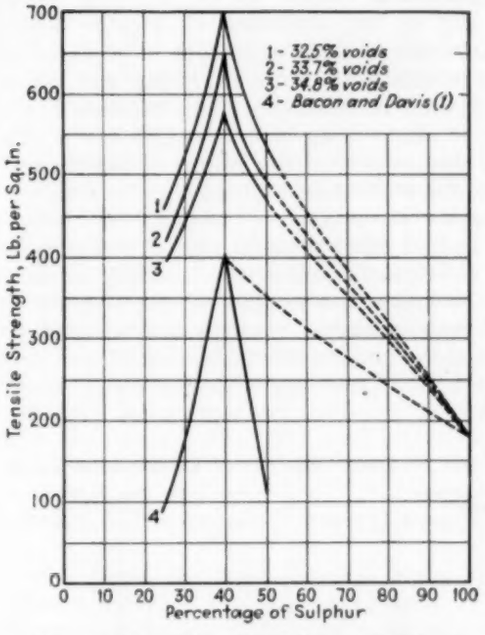


Fig. 1—Strength of sulphur cements as related to voids in the aggregate

Properties of Sulphur-Sand Mixtures

Reference has been made to cements that are prepared by incorporating sand in molten sulphur. Such cements deserve to be better known to chemical engineers, because they are highly resistant to sulphuric acid, possess desirable physical properties, especially strength, and are easy to prepare. There has, however, been a dearth of information respecting the influence of size of sand particles upon the tensile strength of these cements; and, accordingly, this subject has been accorded investigation at Mellon Institute during the course of this broad investigation of sulphur cements.

Presented by the author under the title of "Some New Sulphur Cements," before the Pittsburgh meeting of the American Institute of Chemical Engineers, Nov. 16, 1934.

Sulphur in the form of figure-eight briquets, such as are commonly used in cement testing, has a tensile strength of approximately 180 lb. per sq. in. Sulphur in the form of a thin film, when used to bond together smooth aluminum blocks, has an adhesion strength of 900 lb. per sq. in., according to McBain and Lee[19]. These data and also the researches in portland cements lead one to anticipate that the grading and the type of aggregate used in making sulphur cements are of importance in determining their strength and workability. The size composition of the system of aggregates which enter into the manufacture of a cement is a factor in determining the workability of the mix, the density of the product and its other physical characteristics. Hence it may be anticipated that, if close packing of the aggregate can be attained, a sulphur cement of good working qualities and maximum strength can be produced, the strength of the product being determined by the amount of sulphur, the type of aggregate and the grading of that aggregate.

Table I—Screen Analysis of Experimental Sands

Standard Screen Mesh		Per Cent by Weight		
Through	On	Sand I	Sand II	Sand III
20	28	1.1	0.8	1.1
28	35	8.8	7.3	10.4
35	48	23.8	19.8	27.6
48	65	15.2	13.0	17.4
65	100	10.9	10.5	11.3
100	150	7.3	8.1	6.6
150	200	8.5	9.9	7.1
200	...	24.2	30.6	18.5
Per cent of voids		32.5	23.7	34.8

In practice, the close packing of the aggregate can be accomplished in two ways, namely, by intermittent grading and by continuous grading. Intermittent grading involves the use of two or more sized aggregates, usually a coarse and a fine, to produce a product of minimum voids. The second involves the use of aggregates of successively decreasing sizes and mixing these to obtain a product of minimum voids. Both of these methods were used to prepare sand mixtures of different voids. To these sand mixtures were added various quantities of sulphur and the tensile strength of the cements so prepared was then determined. Data regarding the strength of cements made with various kinds of sized silica sand are shown in Fig. 1. For comparative purposes there are also included data taken from an article by Bacon and Davis[1]. These authors did not specify the type of sand nor the percentage of voids in the sand they used. It is assumed that they employed an ungraded sand containing 40.8 per cent voids. The screen analyses of the other sands used in these experiments are given in Table I. The composition of the various cements is expressed in percentage by weight.

Strongest Cement 40 Sulphur-60 Sand

The data of Table I show that the strength of sulphur cements is related to their sulphur content and to the percentage of voids in the sand used in their fabrication. Regardless of the grading of the sand, cements of greatest tensile strength are obtained by mixing 40 per cent of sulphur with 60 per cent of sand. With a given quantity of sulphur the strength of the cements increases as the percentage of voids in the sand decreases. The strongest cement is obtained with a sand containing 32.5 per cent voids.

When ungraded sands containing 40.8 per cent voids are used, it was found that the strongest cements could be made with the sand of smallest particle size. A number of ungraded sands were mixed with 39 per cent sulphur. The cement made with coarse sand, most of which passed through an 8-mesh sieve but was retained on a 28-mesh sieve, had a tensile strength of 220 lb. per sq. in. The cement made with medium sand, most of which passed through a 28-mesh sieve but was retained on a 65-mesh sieve, possessed a tensile strength of 315 lb. per sq. in. The cement made with fine sand, 60 per cent of which passed through a 200-mesh sieve, had a tensile strength of 510 lb. per sq. in.

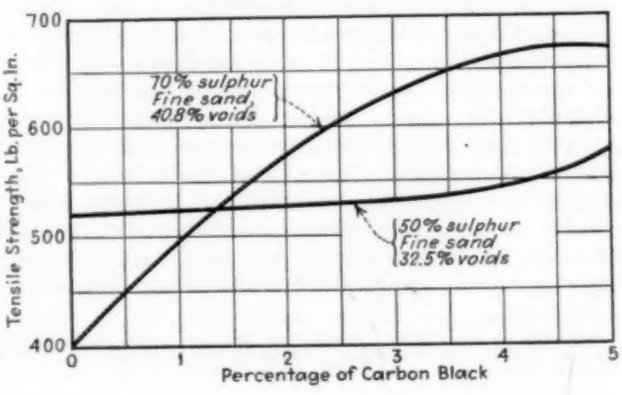
Improving Workability of Sulphur Cements

Cements of maximum tensile strength can be made by mixing 40 per cent by weight of sulphur with 60 per cent of sand, but such cements are not always suitable for commercial work. Generally they are stiff and pasty and are poured with difficulty. For practical reasons it has, therefore, been found necessary to use more than 40 per cent of sulphur in cement.

The factors that determine the workability of sulphur cements have not been definitely ascertained. The surface characteristics of the various aggregates are probably of importance, regarding both the workability and the strength of such cements. Some surfaces are probably more easily wetted and bonded than others. It is quite likely that these surface effects may be modified by the adsorption of capillary-active substances or by the addition of materials to the sulphur to change its surface tension, contact angle, or its ability to wet various surfaces.

One of the materials that has a marked influence on the workability of sulphur cements is carbon black. The addition of 2 per cent of this material to any sulphur cement retards settling of aggregate and at the same time improves its working characteristics. Furthermore, the strength of the cement is increased by such additions. This increase in strength is more apparent with cements containing a large proportion of sulphur, as is shown in Fig. 2. According to these data the tensile strength of a cement containing 70 per cent of sulphur can be increased from 405 lb. per sq. in. to 670 lb. per sq. in. by replacing 5 per cent of the sand with carbon black, an increase in strength of more than 65 per cent. This ce-

Fig. 2—Effect of carbon black on the strength of sulphur cements



ment has excellent working qualities and shows little tendency to settle.

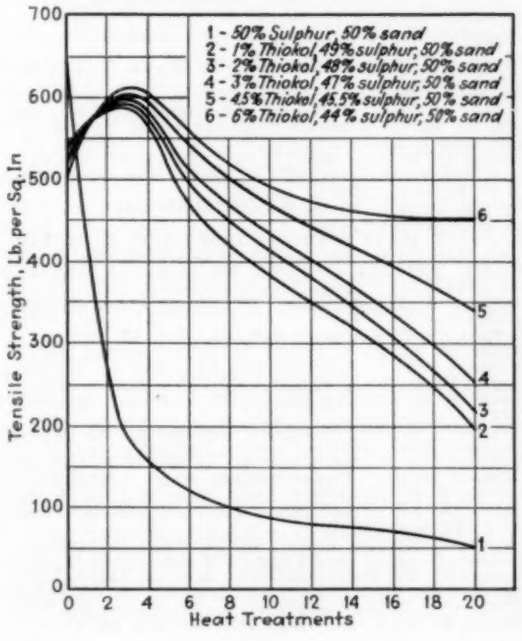
Thermal Characteristics of Sulphur Cements

One objection cited against sulphur cements is that they have been known to fail under very peculiar circumstances. Pipes have been joined with them and in time it was asserted that the joint had failed and that the cement had become granular and crumbly. That such failures may result is not altogether improbable. Solid sulphur may be regarded as a conglomerate of two modifications or of two enantiotropic crystalline forms, rhombic and monoclinic. Its character is dependent upon its previous history and must be considered in relation to various modifications of the liquid sulphur from which it was formed. At ordinary temperatures rhombic sulphur can exist unchanged. On being heated to temperatures somewhat below the melting point, it passes into the prismatic variety. On the other hand, at temperatures above 96 deg. monoclinic sulphur may remain unchanged, whereas at ordinary temperatures it passes slowly into the rhombic form. This change progresses from the interior of a mass of crystals outward, and fissures and cracks are formed in the mass. Although these changes may not occur very rapidly at ordinary temperatures they are accelerated by fluctuating temperatures. Hence it may be supposed that the failure of commercial sulphur cements in certain instances may be attributed to the changes in the crystalline structure of sulphur.

That such changes occur in sulphur cements can be demonstrated. Bars 1 × 1 × 8 in. were cast from various commercial sulphur cements. After being allowed to set, the bars were subjected for 5 minutes to hot water (84 deg. C.) and then for 5 minutes to ice water (4 deg. C.). Not more than 5 seconds elapsed between immersions and each set of bars was subjected to 18 cycles or 18 heat treatments. Part of the bars were subjected to the heat treatment one day after being cast and a second lot was subjected to the heat treatment 10 or 12 days after being cast. The lengths of the bars at the beginning and at the end of the test were carefully determined.

It was found that all the commercial sulphur cements tested grew when subjected to fluctuating temperatures. Their growth seems to be related to their age. Those tested one day after being cast were found to have increased in length from 0.015 to 0.25 per cent. Those tested ten days after being cast were found to have increased in length 0.08 to 0.44 per cent. Furthermore, it was noticed that the bars of cement that had an original modulus of rupture of approximately 1,500 lb. per sq. in. had become so weak, after being subjected to fluctuating temperatures, that they could be broken by hand. The phenomenon of the growth of such cements when exposed to fluctuating temperatures may explain in part why these failed in service. It may be that, in the particular instances noted, the cements recrystallized, grew and failed.

Fig. 3—Effect of Thiokol on the resistance of sulphur cements to thermal shock


1 - 50% Sulphur, 50% sand
2 - 1% Thiokol, 49% sulphur, 50% sand
3 - 2% Thiokol, 48% sulphur, 50% sand
4 - 3% Thiokol, 47% sulphur, 50% sand
5 - 4.5% Thiokol, 45.5% sulphur, 50% sand
6 - 6% Thiokol, 44% sulphur, 50% sand
Tensile Strength, Lb. per Sq. In
Heat Treatments
0
100
200
300
400
500
600
700
0 2 4 6 8 10 12 14 16 18 20

Admixtures to Improve Thermal Resistance

It is well known that the crystalline habits of various materials are modified by the presence of so-called foreign substances. In the search for some substance that would modify the crystalline habits of sulphur, it was discovered that various sulphides could be dissolved in sulphur and that, with their aid, the characteristics of sulphur could be altered. With sulphides such as those of phosphorus[11] or arsenic,* we have found that it is possible to produce plastic masses resembling enamels. With the aid of organic sulphides,* it is possible to produce masses of varying plasticity. Of these modifying agents, Thiokol, an olefine polysulphide manufactured by the Thiokol Corp., Yardville, N. J., is well adapted for use in sulphur cements. This material is soluble in sulphur and with its aid it is possible to produce cements of varying plasticity that are resistant to thermal shock. In Fig. 3 are given data relating to the influence of Thiokol on cements subjected to heat treatments previously described.

It is apparent from these data that cements containing only sulphur and sand lose approximately 50 per cent of their tensile strength after being subjected to three heat treatments. Cements containing Thiokol actually gain in strength when subjected to similar treatment. Ordinary sulphur cements became so weak after 12 heat treatments that they could be broken by hand. Cements containing Thiokol retained 50 per cent or more of their original strength even after being subjected to 20 heat treatments. Although the resistance of cements to fluctuating temperatures seems to increase as their Thiokol content is increased, for practical purposes the addition of 1 per cent of Thiokol is ample to protect them from thermal shock.

The resistance of sulphur cements containing Thiokol to temperature changes was also demonstrated in a practical manner. Two tiers of bricks were prepared. One was joined with a commercial sulphur cement, the other with a sulphur cement containing 1.50 per cent of Thiokol. Both tiers were submerged in an acid pickling tub

*Patent protection on the use of these is being sought.

and placed so that the steam used to heat the acid impinged directly on the bricks. The pickling tub was used only during the daytime and allowed to cool at night. Under these severe conditions the commercial cement failed completely in two days. The cement containing Thiokol, on the other hand, showed no signs of deterioration until it had been in continuous service for two months.

Besides increasing the resistance of sulphur cements to thermal shock Thiokol also has an effect on their plasticity. The modulus of rupture of the cement is decreased slightly by the addition of Thiokol (see Fig. 4), but not great enough to be of serious consequence.

Applying the principles discussed, it is possible to produce sulphur cements of excellent strength that can be easily applied and are resistant to thermal shock. A summary of the composition and physical characteristics of several typical sulphur cements is given in Table II.

Chemical Resistance of Sulphur Cements

As sulphur is comparatively inert to many chemical agents, its use is suggested in structures subjected to corrosive liquids and fumes. The application of sulphur cements to such purposes is conditioned by the inertness of the aggregate mixed with the sulphur. Sulphur cements of proper type are resistant to sulphuric acid and are not attacked by hydrochloric acid except in the presence of large quantities of iron. Evidence has also been obtained that they are resistant to 40 per cent nitric acid. Although such cements are resistant to the mineral acids and their salts, they are attacked by concentrated solutions of alkaline hydroxides. They are also attacked by oils, particularly vegetable oils. Detailed data regarding the chemical resistance of sulphur cements are not available, but such information is being accumulated and will be presented in a subsequent paper.

As sulphur cements are resistant to acids and corrosive liquids, their use is suggested in the construction of acidproof floors and walls, pickling tanks such as described by Fritz[10], and in the installation of sewers and drains. They can also be used in the construction of ventilation shafts, chimneys and flues and in protecting

Table II—Composition and Physical Characteristics of Sulphur Cements

Composition of Cement

Number	Percentage by weight 1	2
Sulphur	58.8	58.8
Thiokol	1.2	1.2
Sand	40.0	38.0
Carbon black*	....	2.0

*Ultramicronex, Binney & Smith Co., New York.

Grading of Sand

Standard screen mesh Through	On	Per cent by weight	
20	28	1.1	....
28	35	8.8	....
35	48	23.8	0.7
48	65	15.2	2.4
65	100	10.9	9.2
100	150	7.3	11.9
150	200	8.5	17.1
200	....	24.2	58.7
Per cent of voids		32.5	40.8

Physical Characteristics of Cements

Tensile strength, figure-eight briquet 1×1 in. section, lb. per sq.in.	576	830
Compression test, cylinder 2×4 in., lb. per sq.in.	3883	6159
Modulus of rupture, specimen 1×1×7 in., lb. per sq.in.	1597	2377
Coefficient of expansion	15×10^{-6}	25×10^{-6}
Growth due to fluctuating temperatures, 18 cycles, per cent	—0.09	—0.04

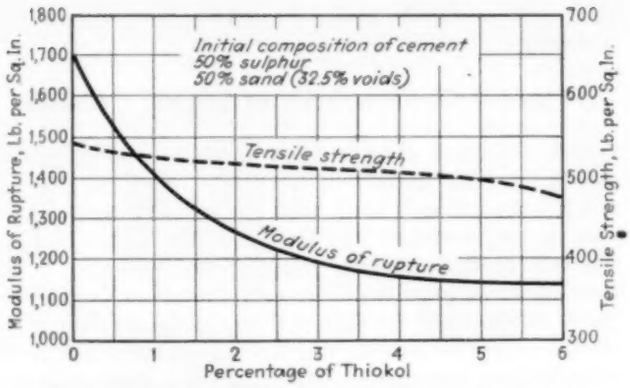


Fig. 4—Effect of Thickol on the modulus of rupture and tensile strength of sulphur cements

brickwork from acid vapors and acid condensates, provided the temperatures encountered are below 94 deg. C. (201.2 deg. F.). They can be employed in cementing bell and spigot pipe joints. In fact, it is anticipated that they should prove to be of particular value in metal pickling and metal-drawing plants, in copper smelting, zinc mining and leaching plants and in the electroplating and electrochemical industries where severe corrosion problems are encountered.

The writer wishes to thank Dr. A. T. Clifford for his valuable services with the experimental work reported in this paper, Dr. C. W. Sweitzer for his part in the research related to carbon black, and the Fellowship donor, the Texas Gulf Sulphur Co., for constantly helpful cooperation during the investigation.

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Developments in Rare Metals

Electrochemists report recent technical and commercial advances among the so-called rare metals at the New York meeting

EDITORIAL STAFF REPORT

THE TECHNICAL SESSION on the rare metals at the fall meeting of The Electrochemical Society brought out much valuable discussion, not only from those working in the rare-metal field, but from many who, through the press of circumstances, have not had an opportunity to acquaint themselves with the more recent developments in this increasingly important field.

The session was in charge of James H. Critchett, vice-president of Union Carbide & Carbon Research Laboratories. The present status of titanium was reported upon by M. A. Hunter and A. Jones of Rensselaer Polytechnic Institute. Commercially titanium oxide, our best white pigment, is today far more important than the metal. The metal has been prepared in a small way by reduction of the chloride with metallic sodium, and its properties investigated. Titanium is half as heavy as copper and can be forged into ductile rods and plates. Dr. J. W. Marden of the Westinghouse company added that his organization had prepared titanium metal by reducing the oxide with calcium metal. There seems to be no doubt that valuable and important applications for titanium metal will follow immediately upon the discovery of a cheap and practical method of reduction.

The situation in the case of metallic vanadium is not far different from that of titanium. Dr. B. D. Saklatwalla, vice-president of the Vanadium corporation, discussed the fundamental properties of the vanadium atom. These are so different from those of any other atom that they may account for many of vanadium's outstanding properties. "The ease with which vanadium changes its valency and consequently the free atomic surface energy must account for its excellence as a catalyst. . . . Vanadium metal as such may show very useful properties and may stimulate simpler and cheaper methods for the production of the pure metal such as electrolysis from a non-aqueous electrolyte," said Dr. Saklatwalla. He further recommended investigating the alloys of vanadium with thorium, tantalum, and columbium.

Westinghouse has for years been developing methods for the production of metallic thorium and uranium. Dr. Marden, in submitting the results of this research work stated that there were three principal uses for metallic thorium and uranium which seem to offer considerable commercial possibility; in photoelectric cells, as glow tube electrodes, and as X-ray targets.

Prof. B. S. Hopkins of the University of Illinois—who a few years ago added two new elements to our list—confined his report to europium. A second paper by Dr. Hopkins and L. F. Audrieth was on the electrolysis of rare metal salts in non-aqueous solvents. Amalgams of lanthanum, cerium, neodymium, samarium, and yttrium were prepared by the electrolysis of saturated solutions of rare earth chlorides in ethyl alcohol, using a mercury cathode.

Prof. Felix Trombe of the University of Paris described experiments on the preparation of pure metals of the cerium group. With a molybdenum cathode and a graphite anode Dr. Trombe obtained very pure samples of cerium, lanthanum, and neodymium and re-determined the chemical and physical properties of these metals in the pure state. The values submitted differ appreciably from older values based on relatively impure metals.

C. L. Mantell and Charles Hardy of New York surprised many of the listeners with their report of a well-established calcium metal industry. They displayed large samples of the product. The metal has been found efficient as a scavenger for lead, copper, bronzes, steel, nickel, and others. Dr. F. C. Frary, director of the Aluminum company's research laboratories referred to bearing metals and emphasized the fact that the addition of a few per cent of calcium and about 3 per cent of barium "makes the lead so hard that it cannot be cut with a hacksaw." Dr. Marden referred to the use of calcium as a convenient reducing agent in preparing rare metals. Dr. R. L. Seabury of the General Motors Corp. considers calcium metal an effective dehydrating agent for alcohol.

A sister metal of calcium which has in recent years rapidly grown in industrial importance is barium. D. W. Randolph of the A. C. Spark Plug Co. described the latest results obtained by his company using a nickel-copper-barium alloy as a spark terminal. Dr. Marden referred to the use of the barium oxide coated electrode in the new sodium and mercury highway lighting units.

A further application of barium was brought out by M. A. Baernstein, of the National Pigments and Chemical Co., in his paper "A New Electric Furnace Technique: The Use of Barium Flux." Using a Detroit rocking furnace it was found that the addition of a mixture of barium oxide and barium carbonate about half an hour before pouring resulted in a more quiet and steady arc, improving the metal and prolonging the life of the furnace lining.

Dr. Hans Osborg of the Maywood Chemical Works gave a detailed account of the new lithium metal indus-

try, emphasizing the outstanding chemical and physical properties of the metal. Among the technical applications are the treatment of molten copper and bronzes with a lithium-calcium alloy. Lithium metal added to magnesium increases its corrosion resistance and tensile strength. Less than ½ per cent of lithium added to aluminum-zinc alloys develops in these mechanical properties similar to those of mild steel. Prof. H. C. Fogg of the University of New Hampshire reviewed the electrochemistry of gallium.

The Norton Co. again submitted a comprehensive report on results of years of research. This time the report concerned the new boron carbide, B_4C. The intrinsic hardness of B_4C exceeds that of SiC. Molded B_4C gave an average modulus of rupture in compression of 18,000 kg./cm². In cross-bending, the modulus of rupture is less than that of cemented tungsten carbide. The resistivity at 20 deg. C. is 0.0132 ohm/cm³; coefficient of expansion between 25 and 800 deg. C. is 4.5×10^{-6}. The carbide is inert in all solutions of acids and alkalis, both concentrated and dilute. Industrially, B_4C is used for drilling cemented tungsten carbide die nibs; nozzles for abrasive blasting; wire drawing dies, and the like.

Shoo-Tze Leo and Tsing-Nang Shen of the University of Peking obtained a very pure tungsten metal by electrolysis of a fused phosphate bath. And M. Leslie Holt of the University of Wisconsin reported on the codeposition of tungsten and iron from aqueous solutions.

Fink and P. Deren of Columbia University succeeded some time ago in obtaining bright mirror plates of rhenium on brass, copper, steel, and other metals; the plate is relatively hard and highly resistant to hydrochloric acid. Various plating baths were developed; the sulphate bath is the one recommended by the authors. The chief present supply of rhenium are certain copper refinery slimes. In these the metal occurs to the extent of about 1 p.p.m., or about the same order of magnitude as gold in many of the copper slimes. Dr. F. L. Jones of the Bausch & Lomb Co. emphasized the demand for a metal surface which would be highly resistant to corrosion, readily applied, and having a high reflectivity value. The resistance of rhenium to hydrochloric acid implies a reflecting surface which is unchanged from day to day.

Richards Memorial Lecture

Dr. Walter S. Landis, vice-president of the American Cyanamid Co., an associate of Dr. Richards for many years, presented a eulogy on Dr. Richards in his Joseph W. Richards memorial lecture entitled "Joseph W. Richards: The Teacher—The Industry."

Dr. Richards was the first president of the Electrochemical Society and its secretary for two decades. He was one of the founders and first president of the company publishing *Electrochemical Industry*, the predecessor of *Chemical and Metallurgical Engineering*. The American electrochemical industry is indebted to Dr. Richards, who always had absolute confidence in the final supremacy of electrochemical methods. His enthusiasm spurred investigators on all over the world and much of the success of the industry today is due to Richards' efforts.

The Friday morning technical session was devoted to the co-relation of electrochemical and physiological reactions, and to the theory of electrolytes. Dr. D. A. MacInnes of the Rockefeller Institute of New York presided. Prof. Charles A. Kraus of Brown University presented his views of the properties of electrolytes as related to their constitution. Potentiometric studies of passivity were made by John Steiner and Louis Kahlenberg of the University of Wisconsin.

Prof. F. A. Rohrman of the Michigan College of Mining and Technology presided at the Saturday morning session, the first part of which was devoted to the corrosion of zinc and aluminum. Anomalies observed in the rate of corrosion of zinc was reported upon by J. E. Maconachie of the Ontario Research Foundation.

Joseph Schulein of Chicago described his method of protecting zinc-coated articles by alternating-current treatment in the chromic acid plating bath. Samples of galvanized sheet thus treated showed marked resistance to corrosion. Prof. Frederick J. Kenny of Manhattan College suggested that the improvement in corrosion resistance observed may be due to film formation which can be obtained without current by anodic treatment. Schulein, however, stated that there was a decided difference between the three coats obtained. Dr. R. M. Burns of the Bell Telephone Laboratories emphasized the importance of having a continuous coat free from any pinholes for absolute protection of the metal underneath.

Electric Furnace Design

A series of tests were carried out by Prof. Rohrman on the effect of heat treatment on the corrosion of high-purity aluminum. J. D. Edwards of the Aluminum Co. of America attributed the results obtained by Dr. Rohrman to the production of a heterogeneous material as a result of the heat treatment.

Of particular interest to electric furnace men was the paper by Prof. Albert B. Newman and Louis Green of Cooper Union on the temperature-history and rate of heat loss of an electrically heated slab. The authors presented a mathematical analysis of the general case and translated the results into tabulated values and curves for application to practical cases. The authors were warmly congratulated for their efforts in solving one of the difficult problems in electric furnace design and operation.

Pres. H. S. Lukens presided at the session devoted to electroplating. William Blum and G. W. Vinal of U. S. Bureau of Standards submitted the approved definitions of polarization, over-voltage, and decomposition potential. Dr. L. C. Pan of the College of the City of New York discussed the best practice in bus bar equipment for plating shops. Fink and T. H. Wilber of the Bullard-Dunn Co., described at length the Bullard-Dunn electrochemical metal descaling process. Pierre A. Jacquet, sixth Western Fellow, studying at the Ecole Pratique des Hautes Etudes in Paris, described a simple method of determining the adhesion of electrolytic copper deposits. The diffusion of plated metal into zinc-base diecastings was discussed by Wilhelm F. Castell of the General Motors Corp. Lawrence E. Stout and Bernard Agruss of Washington University contributed a paper on alloys of cadmium, zinc, and tin. Prof. O. P. Watts of the University of Wisconsin presented his views on voltaic action and corrosion. The electrochemical theory of corrosion Professor Watts believes is unfounded.

CHEM. & MET. DIRECTORY OF PLASTICS

The many changes that have been made among plastic materials since *Chem. & Met.* published its first directory of Plastic Products and Producers in August, 1931, has necessitated supplemental lists in 1932 and 1933. Believing it timely to revise the several tabulations, the editors have again invited A. F. Randolph of the chemical department of du Pont Viscoloid Co., Arlington, N. J., to make the compilation. Although the author has had the cooperation of Dr. Franz Pabst, editor of *Plastische Massen,* Troisdorf, Germany, and M. Forrer, Manufacture d'Isolants et Objets Moules, Vitry-sur-Seine, France, and other authorities in making the revision it is quite conceivable that some compounds listed have disappeared and that significant names have escaped attention. Corrective comments from readers of this list are heartily welcomed.

DESCRIPTIVE CODE AND ABBREVIATIONS

C	Casein	PX	Pyroxylin	l	Laminated goods
CA	Cellulose Acetate	SG	Safety glass	m	Molding compound
G	Glycerol-phthalic anhydride	UF	Urea-formaldehyde	p	Packaging material
PF	Phenol-formaldehyde	V	Viscose	s	Soluble

f Fabricator's trade name, not necessarily same as trade name of the material used
t Turnery material, from which articles are made by machining
x Material furnished in sheets, rods, tubes, from which articles are made by die-pressing, molding, machining, blowing
‡ Material known or believed to be obsolete or discontinued

Blücher—"Plastische Massen," by Hans Blücher, (S. Hirzel, Leipzig, 1924)
BPY—*British Plastics Yearbook*, (Plastics Press Ltd., London)
Brit.Plast.—*British Plastics and Moulded Products Trader*, (Plastics Press, Ltd., London)
CGP—*Le Caoutchouc et la Gutta-Percha*, (same, Paris)
Hemming—"Plastics and Molded Electrical Insulation," by Emile Hemming, (Chem. Cat. Co., N. Y., 1923)
Kausch—"Handbuch der künstlichen plastischen Massen," by Oskar Kausch, (Lehmann, München, 1931)
Kunststs.—*Kunststoffe*, (Lehmann, München)
Mehdorn—"Kunstharzpressstoffe," by W. Mehdorn, (VDI Verlag, Berlin, 1934)
Plastics—*Modern Plastics*, (formerly, **Plastic Products, Plastics**), Breskin & Charlton Pub. Co., New York
Pl M—*Plastische Massen*, (Verlag Physik, Troisdorf, Germany)
RGMP—*Revue Générale des Matières Plastiques*, (same, Paris)
S&S—"Artificial Resins," by Scheiber & Sändig, tr. Fyleman, (Pitman, London, 1931)
Sommerfeld—"Plastische Massen," by A. Sommerfeld, (Springer, Berlin, 1934)
Transparentfolien—"Transparentfolien," by M. Halama, (Bodenbender, Berlin, 1932)

Name	Description	Manufacturer or Reference
Abalak	PF s‡	Kunstharzfabrik Dr. Fritz Pollak, Wien
Abalyn	Resin plasticizer	Hercules Powder Co., Wilmington, Del.
Ace-Ite	Bitumen base	American Hard Rubber Co., New York
Acele	Cellulose acetate silk	du Pont Rayon Co., Wilmington, Del.
Aceloid	CA,m	General Plastics Corp., Ltd., London, SE 13
Acéloid, **Aceloide**	CA	Cie. du Celluloïde Petit-Collin-Oyonnithe, Paris
Acelose	CA ?	American Cellulose Co., Indianapolis, Ind.
Acéta	CA	Cie. du Celluloïde Petit-Collin-Oyonnithe, Paris
Acetaloid	CA, m, x	Acetate Products Corp., Ltd., London, EC 4
Acetex	CASG	Acetex Safety Glass Co., Ltd., London, EC
Acetoid	CA	Punfield & Barstow, Ltd., London, EC 2
Acétoid	CA, film, etc	Soc. Pathé-Cinéma, Paris
Acetol	Cellulose acetate flake	Soc. Rhone-Poulenc, Paris
Acétophane	CA, p	Soc. Industrielle de l'Acétophane
Acetyloid	CA	Dai Nippon Celluloid Co., Ltd., Osaka, Japan
Acetylon	CA	Dynamit A.G., Troisdorf, Germany
Acidur	Acid-resistant moldings	Cable Mfg. Co., Ltd., England
Acrolite	Phenol-glycerol m & l	Continental Diamond Fibre Co., Bridgeport, Pa.
Adarola	C, f	Jose Oregui, Renteria, Spain
Adit	m	Gebr. Adt A. G., Wächtersbach, Germany
Ad-Triplex	SG, with lithographed interlayer	Triplex Safety Glass Co.
Aerialite	Synthetic resin	S. Allcock & Co., Ltd., England
Aerolite	SG	Duplate Corp., Pittsburgh
Aeroplex	SG	Aeroplex, Ltd., England
Aeternit	Denture	Sommerfeld 143
Aethrol	PX, CA	**Kunstst. 22**, 177 (1932)
Aevolit	See Haefelyte	
Agalit		**Kunstst. 6**, 235 (1916)
Agalith		**Plastics**—1, 12 (1925)
Agalithe		R. Meytraud, Pontoise, France
Agalyn	PX, denture	J. D. Whyte, Pittsburgh
Agatine	PF, t	Soc. Nobel Francaise, London, EC 1
Agfa-Pelloro	Thin sheeting	I. G. Farbenindustrie, Germany
Agfa Viscose	Artificial sponge	I. G. Farbenindustrie,
Aico	Cold-molded	American Insulator Corp. New Freedom, Pa.
A-K	PF, m asbestos filler	Dr. Kurt Albert G.m.b.H., Amöneburg, Germany
Akalit	C	Akalit Kunsthorn-Werke A. G., Wien
Akrol	Glycerol resin	U. S. S. R.
Aladdinite	C	Aladdinite Co., Inc., Orange, N. J.
Albane	Plastics	Soc. Rhodiaseta, Paris
Alberit	PF, t	Chem. Fabr. Dr. Kurt Albert, Wiesbaden, Germany; Scott, Bader & Co., Ltd., London, WC 2
Albertat	Aluminum salt of Albertol, q.v.	
Albertol	PF, m, s, t	Chem. Fabr. Dr. Kurt Albert, Wiesbaden, Germany
Albolit	PF, t	Augsburger Kunstharz-Fabrik, Augsburg, Germany
Alboresin	UF ‡	See Resopal
Alborid	PX	Kausch 271
Alcalit	See Alkalit	
Alcolite	PX, denture	Alcolite, Inc., Philadelphia
Aldur	UF, m, t	Aldur Corp., Brooklyn, N. Y.
Aldydal	Synthetic resins	I. G. Farbenindustrie, Frankfurt, Germany
Alftalat	Resins	Kurt Albert G. m. b. H, Amöneburg, Germany
Algalith	Algine plastic, ‡	de Charrard, Rueil, France
Algine	Algine plastic	Kausch 271
Alino	PX, f	R. Strauss, Frankfurt, Germany
Alkalit	Phenolphthalein resin	**Ind. Eng. Chem. 24**, 63 (1932)
Alkalit	C	Alkalit Kunsthornwerke, A. G.
Alkanite	f	Athol Comb Co., Athol, Mass.
Alloy C	Synthetic resin	William Jessop & Sons, Ltd.
Alresal, **Alresen**		Dr. Kurt Albert, G.m.b.H., Amöneburg, Germany
Alsimag	Magnesia, alumina	American Lava Co., Chattanooga, Tenn.
Alvar	Vinyl resin	Shawinigan Chemicals, Ltd., Montreal
Amalith	PF	Kausch 271
Amberdeen	PF	Kausch 271
Amberglow	PF, t	Laboratoires Industriels d'Asnières, Paris
Amberit	PF	Kausch 271
Amberol	Varnish resin	Resinous Products Co.
Ambloid	C	Dai Nippon Celluloid Co., Ltd., Osaka, Japan
Ambra	PF, t	**Plastics 4**, 263, (1928)
Ambrasit	PF, t	Chem. Fabr. Ambrasit, Wien
Ambroid	Pressed amber	Blücher 188
Ambroin	Copal, filler	Allgemeine Elektrizitäts Ges., Berlin
Ambroin	PF, etc	Vereinigte Isolatorenwerke A. G., Wien
Ambroine	x	Soc. Grandgener, Perreux, France
Ambrol	Soluble synthetic resin	Blücher 216
Amerine		American Insulator Corp. New York
Amerith	PX, x	Celluloid Corp., Newark, N. J.
Amerloid	f	Amerloid Mfg. Co., Brooklyn
Amiaco	Insulation	Soc. l'Electro-Isolant, Paris
Amiantine	PF, (?)	Soc. Roux, Paris
Amzylolithe	CA	Soc. Lyonnaise de Celluloïde, Lyons, France
Annal th	Gypsum plastic	Blücher
Annealogic	Insulating substances	Telegraph Constr. & Mntnce. Co., Ltd., London, EC 3
Apex	f	Apex Specialty Co., Brooklyn
Apiroid	PX	Kausch 271
Aquaresin	Water-soluble synthetic resin	Glyco Products Co., Brooklyn, N. Y.
Arbolith	Fibre board	Darson & Cie., Marseilles
Arcolite	PF, f	American Record Corp., Scranton, Pa.
Ardenite	Synthetic resin, m	F. G. Stokes, Ltd., Broadheath, Altrincham, England
Argolit	C	Argo Chem. & Nahrungsmittel Fabr., Prerov, Czechoslovakia
Argonite	PX	Kausch 272
Aristocrat	f	Athol Comb Co., Athol, Mass.
Arki	Wallboard, Algine binder	Isoleringsfabriken Arki Aktiebolag, Stockholm
Armorplate Glass	SG, "hardened glass"	Pilkington Bros., Ltd., St. Helens, England
Aroclor	Chlorinated diphenyl resins	Swann Chemical Co., Anniston, Ala.
Artriplex	SG, colored interlayer	Triplex Safety Glass Co., of N. A.
Asbestite	m, asbestos-cement	Mfre. d'Isolants et Objets Moulés, Vitry-sur-Seine, France
Askol	PF	Anglo-Scottish Chemical Co. L d.
Astra	f	"Astra" Spritgiesserei, Wien
Astrinite	Bitumen base	General Plastics Corp., Ltd., London, SE 13
Athrombit	PX, f	F. & M. Lautenschläger, G.m.b.H., München
Atlas	PF, l	H. Clarke & Co., Ltd., Manchester, England
Atlastik	PX, f	Atlas Ago Chem. Fabr. A. G., Leipzig

Name	Description	Manufacturer or Reference
Australite		**Plastics 1** 12 (1925)
Avecolite	PF, l	BPY 1932
A-W 2	Synthetic resin	I. G. Farbenindustrie, Germany
Axolith, **Axolithe**	C	Soc. Oyonnaxienne, Oyonnax, France
A Winto	PX, f	Adolf Winter, Ober-Esslingen, Germany
Bakdura	PF	**Plastics 6**, 705, (1930)
Bakelaque	PF, l	Attwater & Sons, Preston, England
Bakelit	PF, m, l, s, t	Bakelit Gesellschaft, Germany
Bakelite	PF, m, l, s, t	Bakelite Corp., New York; Bakelite, Ltd., London, SW 1; Soc. della Bakelite, Ferrania, Italy
Balenit	Shellac base	**Kunstst. 10**, 110 (1920)
Banda	f	Brookes & Adams, Ltd., England
Bandalasta	UF, f	
Barkalait		U. S. S. R.
Basselon	f ‡	C. Basse & Cie., Lüdenscheid, Germany
BCM/ Brownie	f	Brownie Wireless Co., Ltd., London, NW 1
Beacon	UF, f	**Plastics 3**, 606, (1927)
Beatl	UF, f	Beatl Sales, Ltd., London
Beaudon Voile	Fabric decorated with PF beads	**Plastics 3**, 362, (1927)
Bebrit	Molding compd.	**Kunstst. 22**, 245, (1932)
Beckacite, **Beck-O-Lac**, **Beckosol**	Synthetic resins	Beck, Koller & Co., Inc., Detroit; Wien
Beerit	Water glass, mineral filler	Blücher 266
Beetle	UF, m	Beetle Products Co., Ltd., Oldbury, Worcestershire, England; Synthetic Plastics Co., Inc., New York
Beetleware	UF, f	Beetleware Corp., New York
Beico		Nobel Chemical Finishes, Ltd., London
Bellaphan	PX, etc	Kalle & Co., A. G., Wiesbaden-Biebrich, Germany
Belleroid		Barret & Elers, Ltd., England
Belling-Lee	C, f	Belling & Lee, Ltd., Ponders End, Middlesex, England
Belplastic	f	Belplastic, Ltd., London, W 10
Bembasell	Cuprammonium process sheeting	I. P. Bemberg, A. G., Wuppertal-Barmen, Germany
Bennetate	CA	B. A. Parker, London E8
Bentene	Aniline-butaldehyde	Naugatuck Chemical Co., Naugatuck, Conn.
Bernit	CA	Zelluloidwaren Fabr., Zollikofen, Switzerland
Beroliet	C, x	Punfield & Barstow, Ltd., London EC 2
Bex, **Bexite**, **Bexoid**	PF, etc., f; f; CA	British Xylonite Co., Ltd., London E4
Bicella, **Bicella-Glas**	Viscose-covered Netting	Kalle & Co. A. G., Wiesbaden-Biebrich, Germany
Bikakapseln	V, bottlecaps	I. G. Farbenindustrie, Biebrich, Germany
Bikarton	PF	**Plastics 6**, 705, (1930)
Bilac	f	W. E. Amies & Co., Ltd., Sheffield, England
Bincolite	Molding compd. resorcinol	Allgem. Elektrizitäts Ges., Berlin
Birmite	UF, f	E. Elliott, Birmingham, England
Bitaphon		J. A. Braun, Stuttgart
Bi-Tripiex	SG	Soc. du Verre Tripiex, Paris
Bituba	PF	**Plastics 6**, 705, (1930)
Black Beauty	f	Rheinische Gummi- & Celluloid-Fabr., Mannheim, Germany
Bogophane	V, p	Soc. Anon, Bogophane
Bois cerame	Gelatine, wood flour	Kausch 272
Bois durci	Wood flour, albuminous binder ‡	Cie. Générale d'Electricité, Paris
Bolta	f	Bolta-Werk, m.b.H., Nürnberg, Germany
Boltalite	f	Bolta Rubber Co.
Bonnyware	PF, UF, f	Reynolds Spring Co., Jackson, Mich.
Book End	Book-binding material of synthetic resin	Kuhn & Jacob Molding & Tool Co., Trenton, N. J.
Bosch-bakelit	PF	Robert Bosch, Stuttgart, Germany
Braylite	Wood flour and binder	American Insulator Corp., New Freedom, Pa.
Bresin	Synthetic resin	Hercules Powder Co., Wilmington, Del.
Britannia	f	Cascelloid, Ltd., England
Britmac	PF, C, f	C. H. Parsons, Ltd., Birmingham, England
Britsulite	PF, m	British Insulite, Ltd., Rochdale, Lancashire, England
Brofo	Coumarone resin	Brown & Forth, Ltd., London NW 1
Brolonkapseln	V, bottle caps	Chem. Fabr., von Heyden, A. G., Germany
Butaceta	PX, etc., f	I. G. Farbenindustrie, Frankfurt
Campbellite	PF, l ‡	Campbell Fibre Co., Stanton, Del.
Camphoid	PX	Kausch 273
Camphorloid	PX	Dai Nippon Celluloid Co., Ltd., Osaka, Japan
Capaille		A. Brémant, Paris
Capes Viscose	V, bottle caps	du Pont Cellophane Co., Wilmington, Del.
Carbolite	PF, m	Soc. Industrielle des Matières Plastiques, Paris
Carboloid	PF, m, ‡	Carboloid Products Corp., New York
Carta	PF, l	Isola Werke, A. G., Düren, Germany
Cascaphane	PX, f	Cascelloid, Ltd., Leicester, England
Caseilithe	C	Soc. Industrielle du Celluloïde, Paris
Casein Lurville	C ‡	Cie. Générale d'Electricité, Paris
Casolith	C	Hollandsche Casolith-Werke; L.M. Mears, London EC1
Catalazuli	PF, t	Catalazuli Mfg. Co., New York
Catalin	PF, t	American Catalin Corp., New York
Cedeco	Coated netting	Haver & Boecker, Oelde, Germany
Cedeite	Molded insulation	Aciéries de Gennevilliers, Gennevilliers, France
Cedra-Glas	Coated netting	Haver & Boecker, Oelde, Germany
Cégélite	PF, m	Cie. Générale d'Electricité, Paris
Celanese	CA	Celanese Corp., New York
Celastic	Box toe fabric	Celastic Corp., Arlington, N. J.
Celastoid	CA, x	British Celanese, Ltd., London W 1
Celerit	Modeling compd	Apotela, Ltd., Zürich
Celescot	PX, m ‡	Celescot Co., Toledo, Ohio
Celestol	Alkyd resin	F. A. Hughes & Co., Ltd., London W 1
Cellubutol	PX	I. G. Farbenindustrie, Germany
Cellanite	Laminated board	Micanite & Insulators Co., London E 17
Cellastine	CA, m, x	British Celanese, Ltd., London W 1
Cellemit	CA	Blücher 153
Cellesta	PX	Verein für Chem. Industrie, A. G., Frankfurt, Germany
Cellglass	V, p	Chem. Fabr. Cellglass, Limburg, Netherlands
Cellindex		Borgeaud & Cie., Montrouge, France
Cellit	Cellulose acetate flake	I. G. Farbenindustrie, Frankfurt, Germany
Cellitfilm	CA	
Cellobase	PX, CA, V, f	Raymond Boisdé, Paris
Cellocaps	V, bottle caps	Edison Swan Electric Co., Ltd., London EC 4
Cellofoil	p	Cellofoil, Ltd., Manchester, England
Celloforme		Soc. la Celloforme, Paris
Celloidinwolle	Gelatinized pyroxylin	**Nitrocellulose 4**, 26,
Cello-Metall	V, sheeting with metal foil	Kalle & Co., A. G., Wiesbaden-Biebrich, Germany
Cellomold	CA, m	F. A. Hughes & Co., Ltd., London W 1
Cellon	CA, x	Dynamit, A. G., Troisdorf, Germany; F. A. Hughes & Co., Ltd., London W 1
Cellon-Drahtglas	Netting coated with CA	Cellon-Werke, G.m.b.H., Berlin-Charlottenburg
Cellophan	V, p	I. G. Farbenindustrie, Germany
Cellophane	V, p	Soc. la Cellophane, Paris; du Pont Cellophane Co., New York; Canadian Industries, Ltd., Montreal
Celloplast	For sealing V, p	**Ind. Eng. Chem. News 10**, 258, (1932)
Celliosliber	PX, with metal coating	R. Kiefer, Dresden
Cellosit, **Celliosite**	CA, p	Ettore Rossi, Milan
Celistop	p	Norway, **Brit. Plast. 2**, 227, (1930)
Celluclaire	PX, p	
Celluin	CA, x, m	Paul Rie & Sohn, Praha, Czechoslovakia
Celluline	PX	Kausch 274
Cellulit	C	Soc. Industrielle du Celluloïde, Paris
Cellulith	Sulphite pulp plastic	**RGMP 6**, 461, (1930)
Celliulodine	PX	Kausch 274
Celluloid	PX, x	Celluloid Corp., Newark, N. J.
Celluloid Lehmann, **Celluloid de Socker**	C	
Cellulosine	PX	Cadoret & Degraide
Cellushi	V, p	Dai Nippon Celluloid Co., Osaka, Japan
Cellusine	p	Langheck & Co., Ltd., London EC 3
Celluvarno		Silicocks Miller Co., South Orange, N. J.
Cellux	V, p	Feldmühle, A. G., Rorschach, Switzerland
Cel-o-glass	Netting coated with CA	Acetol Products, Inc., New York
Celoron	PF, l, m	Continental Diamond Fibre Co., Celoron Co., Bridgeport, Pa.
Cel-O-Seal	V, bottle caps	du Pont Cellophane Co., Wilmington, Del.
Celotex	Bagasse board	Celotex Co., Chicago
Celta		**Nitrocellulose 1**, 133, (1930)
Celtid	PX, x	Rheinische Gummi- & Celluloidfabrik, Mannheim-Neckerau, Germany
Celtid-Köpfe		Jul. Meyer, Buxbaum & Cie., Mannheim
Celusa	Netting coated with CA	Vereinigte Stahlwerke, A. G., Hamm, Germany
Cerite	PF, s ‡	Clément & Rivière, Paris
Certoplast	f	Vorwerk & Sohn, Wuppertal-Barmen, Germany
Cervinite	CA	Zelluloidwaren Fabrik, Zollikofen, Switzerland
C-E 950	PF, m, dentures	Coe Laboratories, Inc., Chicago
Cetaphane	V, p	Transparent Paper, Ltd., Bury, England
Cetec	Cold molded	General Electric Co., Pittsfield, Mass.
CF board	PF, l	Campbell Fibre Co., Stanton, Del.
CGE	f	Cie. Générale d'Electricité, Paris
Charmoid		Charmette Co., Inc., New York
Chatterton's compound	Gutta percha resin, etc	Kausch 274
Chauvelglas	Wire-reinforced glass	C. Tielsch, G.m.b.H., Altwasser, Germany
Christolit	PF, f	Christophery, G.m.b.H., Iserlohn, Germany
Chromopasta	Gypsum compd.	Blücher
Chrystalate	Hot molded	Hemming 179
Ciba, **Cibanite**, **Cibanoid**	UF, m; ; UF, m s	Ges. für Chem. Industrie, Basel, Switzerland
Cilkloid	PX, surgical wrapping	U. S. A.
Cinelin	PX, CA, refined film scrap	Cinelin Co., Indianapolis
Cinerit		Pétrier, Tissot & Raybaud, Switzerland
Cirdura		Siegel & Stockman, St. Ouen, France
Ciro	PX, sound records	Celluloid Printers, Ltd., England
Ciron		Chem. Ind. Reuschenberg, Leverkusen, Germany
Citalo	SG	Soc. Anon. Citalo, Lodelinsart, Belgium
Clar-Apel	V, p	du Pont Cellophane Co., New York
Clarifoil	CA, p	British Celanese, Ltd., London
Claritone	f	Ashley Wireless Telephone Co., London
Clarophan	Gelatine foil	Continental Gelatine Industrie, G.m.b.H., Michelstadt, Germany
Claudilithe		**Plastics 2**, 396, (1926)
Clematélite	Gum compd.	Soc. Suisse de Clematélite, Vallorbe, Switzerland

Name	Description	Manufacturer or Reference
Clematite	Bituminous base	Kausch 275
Clonaline	Resins	Soc. Résines et Vernis Artificiels, Lyons
Clubman	F	A. W. Kanis, London EC 1
Codite	Vulcanised fibre	Soc. la Fibre Diamond, La Plaine-St. Denis, France
Cogebi	PF, f	Cie. Gén. Belge d'Isolants, Bruxelles
Colasta	m	Colasta Co., Inc., Hoosick Falls, N. Y.
Colbox	Insulating material	Blackall Bros., Ltd., London E 15
Coltrock, **Coltstone**	PF, cold molded	Colt's Patent Fire Arms Mfg. Co., Hartford, Conn.
Compo-Site		Compo-Site, Inc., Newark, N. J.
Concordia	f	ConcordiaElectric Safety Lamp Co., Cardiff, Wales
Condensit-Cellulac, **Condensit-Cellulose**	PF, l	
Condensite	PF, m	Kausch 275
Condulatum, **Conduline**		Bakelite Corp., New York
Copal D22	Synthetic resin	Mica Insulator Co., New York
Coraline	PX	Oskar Block, Hamburg
Coralithe		**Plastics 1**, 11, (1925)
Cornit		Kausch 275
Cornit	m	H. Weidmann, Ltd., St. Gallen, Switzerland
Cornit	Pressed paper	Blücher
Cornoid		**Plastics 2**, 123, (1926)
Coronal	UF	Soc. l'Ambrolithe, Paris
Corozite	C	Soc. Anon. Prodotti Italiana Corozite, Gorlago, Italy
Coupagine	f	L. Rustin, Clichy-la-Garenne, France
Crayonne	CA, ?, m, f	Crayonne, Ltd., Bexley, Kent, England
Craypax	p	Waxed-Bags, Ltd., London NW 10
Crepophane	p	Linium Products Syndicate, Ltd., Nottingham, England
Cresophane	PF, etc. ‡	Cie. Franc. d'Exploitation des Procédés Plinatus, Paris
Cristaloid	PF, t, "organic glass"	France
Cristal organique, **Cristal synthetique**		Mme. G. A. Lacroux, Bois-Colombes, France
Cristalux	CA	Anciens Etablissements Bardet, Paris; Acetate Products Corp., Ltd., London EC 4
Cristore	CA, (?)	Speights Ltd., England
Crommold, **Cromward**	f	Cromwells, Ltd., Dudley Port, England
Crystalate	Sound records	Crystalate Gramophone Record Mfg. Co., Tonbridge, England
Crystalite		Crystalite Corp.of America, Woodside, N. Y.
Crystalite	CA, f	Bolta Rubber Co.
Crystalite		Röhm & Haas, Philadelphia
Crystalithe	Transp. resin	Léon Castany, Paris
Crystallite	UF, m	**Plastics 2**, 14, (1926)
Crystalloid		Mme. G. A. Lacroux, Bois-Colombes, France
Crystallone	f	Paul Schlochoff, Paris
Crystex	V, p	P. P. Shapland, London EC 4
Crystillin	PF, t	Crystillin Products Corp. Brooklyn
Crystur	UF, t	Panplastics, Heyden Chem. Co., Garfield, N. J.
Cumar	Coumarone resin base	Barrett Co., New York
Cupren	Copper-acetylene	Kausch 275
Cuprophon	Cuprammonium film	**Chem. Age 31**, 65, (1934)
Cuprozell	see Bembaxell	
Curvitas	f	A. W. Kanis, London EC 1
Cygnet	Resin, f	Edison Swan Electric Co. Ltd., London EC 4
Daka-Ware	f	Harry Davies Co., Chicago
Dako	m	Commercial Utilities, Ltd., London EC 1
Damarda	PF, s	Bakelite, Ltd., London
Dartex	Chlorinated rubber	Metallgesellschaft & Schiedeanstalt
Daspi	f	Deutsches Allgem. Spritzgusswerk m.b.H., Nürnberg, Germany
Decoroid		Howard Specialties Co., Inc., Brooklyn
Decosan		Shanks & Co., Barrhead, England
Deedoid	f	Aberdeen Comb. Works, Aberdeen
Defiance	C	Jos. Nathan & Co., Ltd., London
Dekorit	PF, t	Dr. F. Raschig, G.m.b.H., Ludwigshafen, Germany
Dentagiene	f	Canadian Industries, Ltd., Montreal
Dentolith	PX, denture	Korrespondens-Blatt für Zahnärzte 57, Heft 3/4
Dermas	Fiber board	**Kunststt. 23**, 255, (1933)
Deverr	m, t	Kreidl, Heller & Co., Wien
Dexonite	For lining chemical equipment	**Chem. Age 29**, 174, (1933)
Dialith		Etabls. L. Peufaillit, Paris
Diaphal	UF	**CGP 27**, 15217, (1930)
Di-El	m	H. Weidmann, Ltd., St Gallen, Switzerland
Dilecto, **Dilecto UF**	PF, l, UF, l	Continental Diamond Fibre Co., Newark, Del.
Dioferrite	PF, corn flour filler	Kausch 276
Dirigo		Ohio Brass Co., Mansfield, Ohio
Dobsoid	C, f	John Dobson, Ltd., Milnthorpe, England
Doloment		Blücher 224
Doplex	Viscose-faced fabric	Mutual Sales, Dobeckman Co., Cleveland
Dorcasine	C	Chas. Horner, Ltd., England
Dorex	PF	Soc. Dorex, Paris
Doverite		Dover, Ltd., Northampton, England
Drott	PX	Baltic-Landmaschinen G.m.b.H. Berlin
DS-Glas	SG	Deutsche Spiegelglas, A. G., Grünenplan, Germany
Dulux	Resins, s	E. I. du Pont deNemours & Co., Philadelphia; Nobel Chem. Finishes, Ltd., Slough, Bucks., England
Dumold	PX, m ‡	du Pont Viscoloid Co., New York
Duo-lite	SG	Duplate Corp., Pittsburgh
Duosine	f	W. & G. Baird, Ltd., England
Duperite	f	Dunlop Perdriau Rubber Co., Melbourne
Duplate	SG	Duplate Corp., Pittsburgh
Duprene	Synthetic rubber	E. I. du Pont de Nemours & Co., Wilmington, Del.
Duprenol	Chlorinated rubber	Ver. Lackfabriken-Grau-Reilno
Dura C	PF, s	**Chem. Markets 30**, 40, (1932)
Duradent	Denture	Bakelite Dental Supplies, London N 3
Durament		Blücher 224
Duranoid	PF	Specialty Insulation Mfg. Co., Hoosick Falls, N. Y. Duranoid Co., Newark, N. J.
Durax	PF, l	Isola-Werke, A. G., Düren, Germany
Durcoton	PF, impregn. textile	Meirowsky & Co., A. G., Porz-am-Rhein, Germany
Durecol	G	Etabls. Kuhlmann, Paris
Durez	PF, m	General Plastics, Inc., North Tonawanda, N. Y.
Durite	PF, m, l	Stokes & Smith Co., Philadelphia
Durium	Resorcinol-formaldehyde	Durium Products Corp., New York
Duroftal	Synthetic resin	Dr. Kurt Albert, G.m.b.H Amöneburg, Germany
Durold	PF	Soc. Bakelite, Paris
Duro-Kerit	m	Plastika, m.b.H., Harburg-Wilhelmsburg, Germany
Durolit		Heko-Werke, A. G., Berlin-Tempelhof
Durolit	PF, t ‡	Soc. du Durolit, Enghien, France
Durophene	PF, m, s	Scott, Bader & Co., Ltd., London WC 2
Duroware	UF, f	Bryant Electric Co., Bridgeport, Conn.
Dux	Resins	Nobel Chemical Finishes, Slough, Bucks., England
Ebénit		Etabls. Grivolas, France
Ebénoid		**RGMP 9**, 325, (1933)
Ebonestos	f	Ebonestos Insulators, Ltd., London SE 15
Ebonite armée	‡	A. Vaucheret, Paris
Ebonitine	Hot molded	Hemming 179
Ebony Wood	Cold molded	Hemming 179
Eburin	Hot molded ‡	Soc. Beguin, Paris
ECA	f	Bruggemann y Cia., Mexico
Ecaille 97%	PF, t	
Edelresanol	Synthetic resin	Resan Kunstharzfabrik, A. G., Wien
Ekco, **Ekcozene**	m, f	E. K. Cole, Ltd., Southend-on-Sea, England
Elastica	SG, synthetic resin interlayer	I. G. Farbenindustrie, Frankfurt
Elastolith	PF, t	Herold, A. G., Hamburg
Elastose	f ‡	J. Vandier, Paris
Elastozon	PX	Kausch 277
Elbelit, **Elbenit**, **Elbolit**	Synthetic resins	L. Brüggemann, Heilbronn, Germany
Electrobestos	Cold molded	Hemming 179
Electroine, **Electrolit**		Etabls. Grivolas, Paris
Electrose	Hot molded	Insulator Mfg. Co., Brooklyn
Elephantide	l	Mica & Insulating Supplies Co., England
Elfenbein maché	Papier maché	Kausch 277
Elfenite	Resin adhesive	Kausch 277
Ellinol	f	Ellison Insulations, Ltd., Birmingham, England
Elmar	Synthetic resin, f	Elmar Mouldings Co., Birmingham, England
Elo	PF, m, s	Birkby's, Liversedge, England
Emperite	f	Moulded Prods. Pty., Ltd., N. Fitzroy, Vict., Australia
Emür	PX, f	Eberhard Müller, Remscheid, Germany
Endura	UF, f	**Plastics 3**, 605, (1927)
Eolit	See Juvelit	
Epok	m	British Resin Products, Ltd., Kingston, England
Ergolith	C	McLeod & McLeod, London WC1
Ericon	Decorative, PF, l	Merritt Eng. & Sales Co., Lockport, N. Y.
Erinite, **Erinofort**, **Erinoid**, **Erinol**	Resins, CA, x, C, x, Resin intermediates	Erinoid, Ltd., London EC 2
Erinoplas	m	
Esbrilith	C	Rheinisches Farbwerk, Berlin
Eshalite	m	Siemens-Schuckert Werke, A. G., Berlin-Siemensstadt
Eslinger Zellglas	V, p	Langheck & Co., G.m.b.H., Esslingen, Germany
Esterol	G	Paramet Chem. Co., N.Y.
Esterpol	Synthetic resin, s	Glyco Products Co., Brooklyn
Estralit	PF	**Plastics 6**, 705, (1930)
Eternit	Cold molded	Hemming 179
Eswelit	Asbestos & binder	Siemens-Schuckert Werke, Berlin-Siemensstadt
Ethanite	Ethylenedichloride-Ca polysulphide	Wilfred Smith, Ltd., London WC 3
Euboolith	Flooring material (inorganic)	Soc. Anon. Euboolith, Paris
Europhane		Fabriques deLaire, Issy, France
Evaplastin	f	Evered & Co., Ltd., England
Exonite	PX	Dover, Ltd., Northampton, England
Extraplast	Insulators	Vorwerk & Sohn, Wuppertal-Barmen, Germany
Exynite		Kausch 277
Fabroil	PF, l	British Thomson-Houston Co., Ltd., London
Fabrolite	PF, m	Commercial Utilities, Ltd., London EC 1
Factis, **Faktis**	Vulcanised oil	
Fantasit	C ‡	Dynamit, A. G., Troisdorf, Germany
Farlite	PF, l	Farley & Loetscher Co.
Faturan	PF, t	Herold, A. G., Hamburg
Fermit	Molding compd.	Isola-Werke, Germany
Ferrozell	PF, (?), l	Deutsche Ferrozell G.m.b.H., Augsburg, Germany
Festelian	f	Dynamit, A. G., Troisdorf, Germany
Fiber Diamond		Dermatine Co., Ltd., London
Fiberloid, **Fiberlon**	PX, x, PF, t	Fiberloid Corp., Indian Orchard, Mass.
Fibestos	CA, sheeting	
Fibrolithoid	PX	
Fibroplast	Synthetic wood	Soc. Nobel Française, Paris
Fimlelite	PF	Italy
Firmoid	PX, CA, f	Bluemel Bros., Ltd., Wolston, England
Flaka-Kapseln	CA, bottlecaps	Kalle & Co., Wiesbaden-Biebrich, Germany

Name	Description	Manufacturer or Reference
Flexo	Resins	Glyco Products Co., Brooklyn
Flexon	Modeling paste	D. C. Thomas, Reading, England
Flirocell		Kalle & Co., A. G., Wiesbaden-Biebrich, Germany
Flitefast	f.	Cascelloid, Ltd., England
Formalite	PF	Bakelite, Ltd., London
Formapet Miocarta	l.	Ioco Rubber & Waterproofing Co., Ltd., Glasgow
Formica	PF, l, UF, l.	Formica Insulation Co., Cincinnati
Formite	PF, t.	Bakelite, Ltd., London
Formolit	m.	Traun & Söhne, Hamburg
Formolith		**Chimie et Industrie 29**, 781, (1933)
Formvar	Vinyl resin	Shawinigan Chemicals, Ltd., Montreal
Futuran	See Faturan.	
Futurit	PF	Kabelfabrik und Draht Industrie, Wien
Fybros	Vulcanized fiber	**BPY** (1932)
Gala	C.	Cie. du Celluloide-Petitcollin-Oyonnithe, Paris
Galakerite	C.	Soc. Ital. Galakerite, Milano
Galalith	C.	Internationale Galalith Ges., Hoff & Cie., Harburg-Wilhelmsburg, Germany
Galapol	Dip polish for C.	
Galathi	C, f.	Lumos & Co., London N 1
Gallia-Rubber	Ebonite plastic	Mfre. d'Isolants & Objets Moulés, Vitry-sur-Seine, France
Galliperle	C ‡	Cie. Générale d'Electricité, Paris
Galoid	C.	
Galux	f ‡	Etablissements Galalithum, Paris
G. & E.	Insulation	Görner & Engels, Dresden
Ganolite	f.	G. Dorgans, Bordeaux
Gansolite		Gansolite, Ltd., Nijkerk, Netherlands
Gapal		**Farben-Chem. 5**, 74, (1934)
Gaudafil	V, p.	
Geaphtal	G.	Allgem. Elektrizitäts Ges., Berlin
Gédélite	Phenol, cresol-formaldehyde	Soc. Huiles, Goudrons et Dérivés, Paris
Geloid	Gelatine base	Germany
Gelva	Vinyl resin	Shawinigan Chemicals, Ltd., Montreal
Gemstone	PF, t.	A. Knoedler Co., Lancaster, Pa.
Gencivex	PF, denture	
Germalith		Blücher 224
Gesundheits-Pass	PX, f.	Braun & Co., Berlin-Tempelhof
Glacetex	SG	Glaceries Réunies, S. A., Bruxelles
Glider	f.	A. W. Kanis, London EC 1
Globerite	C.	Soc. Ind. Globerite, Milano
Glorit	C.	Schiel & Co., Sternberg, Czechoslovakia
Glorith		
Glutoid	Gelatine base	
Glutol		U.S.S.R.
Glutolin	Cellulose derivative adhesive	Kalle & Co., Wiesbaden-Biebrich, Germany
Glycolac	G.	Etablis. Kuhlmann, Paris
Glycolite	U.F. (?) m.t.s.	Glycolite Co., New York
Glyptal	G, t, s	General Electric Co., Schenectady, N.Y. Etablis. Kuhlmann, Paris
Glyptanite	G & mica	Micanite & Insulators Co., Ltd., Walthamstow, England
Gnu-Wrap	V.	British "New-Wrap" Co., Manchester, England
Grafitex	l.	Gatke Corp., Chicago
Gramophoid	m for sound records	General Plastics Corp., Ltd., London SE 13
Granitol	PX decorated fabric	Deutsche Pluviusin, A. G., Germany
Griffin		New Yorker-Hamburger-Waren Corp., Hamburg
Guardax	SG	Guardax Safety Glass, Ltd., London EC 3
Gummite	Bituminous base, m.	Mfre. d'Isolants & Objets Moulés, Vitry-sur-Seine, France
Gummon	Asphaltic base	Isolatoren-Werken, München
Gummon	Cold molded ‡	Venditor, G.m.b.H., Berlin
Haefelyte	PF, t.	Emil Haefely & Cie., Basel, Switzerland
Hagolit		Gebr. Eckert, Nürnberg, Germany
Hai-Ho	PX, f.	Hainich-Holz, G.m.b.H., Langensalza
Haimanit	Albuminous base	Kausch 279
Halex	f.	British Xylonite Co., London EC4
Halizite	PF	Halizite Corp., N.Y.
Halolume	CA, f.	British Electrical Installations Co., London WC 1
Halowax	Chlorinated naphthalene	Halowax Corp., New York
Hares	PF, m, s	Römmler, A.G., Spremberg, Germany
Haresit	PF	
Haresit Platten	PF, l.	
Harex	PF, l.	
Harlequin	UF, f.	England
Harvite	m, f.	Siemon Co., Bridgeport, Conn.
Haskelite	PF, l, paneling	Haskelite Mfg. Corp., Chicago
Hastra	C.	Hastra Kunstharz-Presswerk, Wien
Haveg	PF, for chemical equipment	Haveg Corp., Newark, Del. Säureschutz Ges., Berlin
Havegit	PF, t.	Säureschutz Ges., Berlin
Hecolite	PX, denture	Heko-Werke, Berlin
Hekolith		
Heleco	PX, f.	H. Lehmann & Co., Frankfurt, Germany
Heliokrepp	p.	Zelligasverarbeitungswerk Berolina
Heliosit	PF, (?)	Römmler, A. G., Frankfurt, Germany
Heliozell	V, p.	Feldmühle Papier- & Zellstoff-Werke, A. G. Stettin
Helius	C, f.	A. & J. Lévy, Paris
Hemcoware	UF, f.	Bryant Electric Co., Bridgeport, Conn.
Hemit	Cold molded	Hemming 179
Heptene base	Aniline-heptaldehyde	Naugatuck Chemical Co. Naugatuck, Conn.
Heraklith	Wood fiber, MgO	**Kunstst. 21**, 124; (1931)
Hercolyn	Synthetic resin	Hercules Powder Co., Wilmington, Del.
Herculite	m.	Colasta Co., Hoosick Falls, N.Y.
Herkolite		General Electric Co., Schenectady, N.Y.
Herolith	PF, t.	Herold, A. G., Hamburg
Heureka	PF, denture	
Hévénoid	Rubber, camphor	Kausch 279
Hightensite		Hightensite, Ltd., England
Histoloid	PX	Kausch 279
Homac	Resin, m.	Walton Chem. Co., Ltd., Liverpool
Hominit	Modeling compd.	Apotela Ltd., Zürich
Hornit	C.	Gottfried Probst, Nürnberg, Germany
Hornmaché	Parchmentized paper, l.	Kausch 279
Hornolith		Gottfried Probst, Nürnberg, Germany
Hortoced	Coated netting	Haver & Boecker, Oelde, Germany
Hurtigsche Holzmasse	Wood waste, water glass	Kausch 279
Hyalin	PX	Friedr. Eckstein, Wien
Hycoloid	PX, CA, tubes, bottles	Hygienic Tube & Container Co., Newark, N.J.
Hydrotex	l, f.	Gatke Corp., Chicago
Hyli	PX, f.	Hygienische Industrie G. Ostertag, Ludwigsburg, Germany
Idealith	C (?)	J. N. Bolkart, Nürnberg Germany
Idelite	PF	Bakelite, Ltd., London,
Iditol	Shellac substitute	U.S.S.R.
Idytol	PF	**RGMP 8**, 295, (1932)
Incriulit	Insulation	Christiani & Nielsen, Hamburg
Inda	C, x.	American Machine & Foundry Co., Brooklyn
Indestructo	SG	Indestructo Glass Corp., Farmingdale, N.Y. Belgian Indestructo Glass Co., S.A., Bruxelles British Indestructo Glass Co., London
Indur	Synthetic resin	Neville Chem. Co. Pittsburgh
Indurite	PF, m.	"Indurite" Sales, Ltd., London SW 1
Industrol	Synthetic resin	Etablis. Kuhlmann, Paris
Infuselax	UF, s.	Beetle Products Co., England
Infusite	m, mineral binder	Mfre. d'Isolants & Objets Moulés, Vitry-sur-Seine, France
Inlite	Asphaltic base	Inland Mfg. Co., Dayton, Ohio
Innophane	V.	Soc. Anon. Innophane, Paris
Inodite	See Ondolta	
Insulate	Hot molded	Insulation Mfg. Co., Brooklyn
Insulit	Synthetic lumber	Backus-Brooks Co., Minneapolis
Insuloid	CA, sheeting	Harold Levey, New Orleans
Insurok	PF, l.	Richardson Co., Chicago
Iperformolo	l.	Soc. Anon. Monti & Martini, Milano
Irgonite	Synthetic resins	J. R. Geigy S. A., Basel, Switzerland
Isoklepa	Insulation	Emil Meyer, Stuttgart
Isolanite	Mg sulphate, water glass	Kausch 279
Isolantite	f.	Isolantite, Inc., Belleville, N.J.
Isolémail	Synthetic resin, s	Soc. des Laques & Isolants, Lyons, France
Isolemite	talc, Mg silicate	
Isolierstahl	PF	**Plastics 6**, 705, (1930).
Isolite		Durand & Sommers, Paris
Isolithe		Soc. Francaise, Lyons, France, Soc. Beguin, Paris
Isoloid	CA	Charles Martin, Levallois, France
Isophan	Ethyl cellulose, p.	Cellonwerke, Charlottenburg, Germany
Isoplac	Insulator	Soc. Isoplac, Paris
Isotex	Synth. resin products ‡	Soc. l'Asbestite, Paris
Isolin	Synthetic resin, s	
Isolith	Synthetic resin.	Kausch 279
Iteco	PF, denture	
Itex	f.	Wright Bros., Ltd., England
Ivaleur	PF, t.	Celluloid Corp., Newark, N. J.
Ivogallith	C	France
Ivoirine	Gelatine base	
Ivoit	PF, t ‡	Etablis. Kuhlmann, Paris
Ivoit-Opal		
Ivorax	PF, t.	Herold, A. G., Hamburg
Ivorid	PX	Kausch 280
Ivoris	f.	French Ivory Products, Ltd.
Ivory Cross	f.	A. W. Kanis, London EC 1
Ivrite	PF	Soc. Anon, Ivra, Torino, Italy
Ivryne	C	Etab. A. Feuillant & Fils
Ixolain	PF, denture	Ixolain-Ges.
Izarine	Suede finish	**Chem. Markets 33**, 56, (1933)
Jacelite	f.	J. A. Crabtree & Co., Ltd., Walsall, England
Jarax	PF, l.	Jaroslaw's erste Glimmerwaren Fabrik, Berlin-Weissensee
Jazolite	PF, f.	Cie. Ind. de Mécanique Horlogerie, Paris
Jewelin	PF, t ‡	Jewelin Corp., Woodside, N. Y.
JMS	Synthetic resin products	JMS, G.m.b.H., Hamburg
Joanite	PF, t ‡	Joanite Corp., Brooklyn
Jonite	Insulating board	Aktiebolaget Torefors Sagverk, Sweden
Jubar-Organ-Glas	Coated netting	Lorch & Hamm, Zweibrücken, Germany
Jurid	m	Kirchbach, Germany
Juvelit	PF, t	Etablis. Kuhlmann, Paris
Juvelith		
Kabelit		Bredovska, Czechoslovakia
Kalanite	Insulation	Callender's Cable & Construction Co., London, EC 4
Kalophan		I. G. Farbenindustrie, Frankfurt
Karben	See Kupren	
Karolith	C, x, m	Karolith Corp., Long Island City, N.Y.
Kasinoid	f.	A. W. Kanis, London EC 1
Kauria	Insulation	P. Carpentier, St. Mandé, France
Keebush	PF, resin & acid-resistant compd.	Kestner Evaporator & Engineering Co., London SW
Kelacoma	UF, m, f.	Kelacoma, Ltd., Welwyn Garden City, England Soc. Nobel Francaise, Paris
Kellite	PF	Kellogg Switchboard & Supply Co., Chicago
Keralon	C.	**RGMP 8**, 87, (1932)
Kerasolith		Keramchemie Berggarten G.m.b.H., Giessen, Germany
Kerit	C, f.	Galalith, Ltd., London EC 1 Int. Galalith-Ges., Hoff & Cie., Harburg-Wilhelmsburg, Germany
Keronyx	C.	Aberdeen Combworks Co., Aberdeen

Name	Description	Manufacturer or Reference
Keronyx	m, from horn ‡	Georges Bonnard, Le Touvet, France
Kétolithe	‡	Soc. anon. le Kétol, Paris
Kétoloid	‡	
K-gutta	Insulator	**RGMP 8**, 188, (1932)
Kilianit	PF, G	Bakelit, G.m.b.H., Berlin
Kinonglas	SG	N. Kinon, Aachen, Germany
Kiebol		**Kunstst. 23**, 32, (1933)
Kieko	Gelatine bottle cap	Transparentfolien 284
K-M	Resin, s	**CGP 30**, 16591, (1933)
Kodaloid	PX, sheeting	Eastman Kodak Co., Rochester, N. Y.
Kodapak	CA, p	Tennessee Eastman Co., Kingsport, Tenn.
Koken	Resin	Nippon Paint Co., Ltd., Japan
Kolinit	Lignite-cresol	Studien & Verwertungs, G.m.b.H., Mülheim, Ruhr
Konsumos		Westdeutsche Kaufhof, A. G., Köln
Kopan	PF, s, m ‡	Kunstharzfabrik, Dr. Fritz Pollak, Wien
Kopoi	Synthetic resin	Beck, Koller & Co., Inc., Detroit
Koraton	PF, t	Wedig & Reuss, Ellenburg, Germany
Kornomit		Kornomit, A. G., Skagen, Denmark
Kupren	Copper-acetylene plastic	Elektrizitätswerke Lonza, Basel, Switzerland
Kyloid	C	Kyloid Co., Muskegon, Michigan
Lacalite, **Lacalith**, **Lacaulite**, **Lacaulith**	Synthetic resins	Soc. d'Appl. des Goudrons & Dérivés, Paris
Lacanite	Shellac base	Scranton Button Co., New York
Laccain	PF	Louis Blumer, Zwickau, Germany
Lackite		Chanoit Frères, Paris
Lacotile	Synthetic lumber, etc	J. Dampney & Co., Newcastle, England
Lacrinite	C, PF, f	Lacrinoid, Ltd., London E 7
Lactilith	C	Chas. Fitzroy, London WC 1
Lactite	C	
Lactitis	C	
Lactoid	C	British Xylonite Co., London E 4
Lactoite	C-PX	
Lactolithe	C, x	Soc. Nobel Francaise, Paris & London EC 1
Lactoloid	C	Dai Nippon Celluloid Co., Osaka, Japan
Lactonite	C, x	British Lactonite Co., London EC 4
Lactonith	C	Erste Estnische Kunsthornfabrik, Tallin, Esthonia
Lactophane	C, p	Poyser Advertising Agency, London EC 2
La Cuille	f	Baff Mfg. Co., North Arlington, N. J.
Laculose H		Grindley & Co., London
Lactélite	C	**RGMP 8**, 87, (1932)
La France	f	Baff Mfg., Co., North Arlington, N. J.
Lakilac	PF, etc., m	Jos. Lucas, Ltd., Birmingham, England
Lamicel	V, coated fabric	**RGMP 7**, 38, (1931)
Lamicoid	l	Mica Insulator Co., Chicago
Laminol	PF, l	Ellison Insulations, Ltd., Birmingham, England
Lancegaye	SG	Lancegaye Safety Glass Co., Ltd., London
Lanoplast	CA, flake	Cellulose Acetate Silk Co., Ltd., Lancaster, England
Lapisite	Artificial marble	Lapisite Marble Products Ltd., Portslade, England
Lasilac	m	Jos. Lucas, Ltd., Birmingham, England
Lastex	Latex threads spun with textile fibers	U. S. Rubber Co., New York
Lathéroide	Vulcanized fiber	Kausch 281
Leatheroid	Laminated paper	Hemming 221
Lennite	PF, denture	Ohio Chem. & Mfg. Co., Cleveland
Leolan		Leo-Werke, G.m.b.H., Dresden
Leuchtol	Synthetic resin	Nippon Resin Kogyo Co., Ltd., Japan
Leukorit	PF, t	Dr. F. Raschig, G.m.b.H. Ludwigshafen, Germany
Lewisol	Resins, s	John D. Lewis, Providence, R. I.
Lignat	Synthetic lumber	Christof & Unmack, Oberlausitz, Germany
Linax	PF, l	Mehdorn 6
Linga-Longa	UF, f	Beatl Sales Co., London
Linge Américain Hyatt	PX, collars	Cie.Générale de Chromolithe, Paris
Linolin	Insulation	Lindsay & Williams, Ltd. Manchester, England
Linsden	f	British Thomson-Houston Co., London WC2
Lissen	f	Lissen, Ltd., Isleworth, England
Lithene	CA, m	Plastic Moulding Co., Ltd., London, N 16
Lithocorn	C (?)	Aug. Elhardt's Söhne, Kempten, Germany
L.M.I.		Soc. le Matériel Isolant, Villeurbanne, France
Locron	UF, s	I.G. Farbenindustrie, Frankfurt
LOF	SG	Libbey-Owens Ford, Toledo, Ohio
Lonarit	CA, m	Lonarit Ges., Berlin-Schöneberg
Lonzoid	CA	Lonza-Werke, Waldshut, Germany
Lorival	PF, t, etc	Lorival Mfg. Co., Ltd., Southall, England
Lor-Wal-Lith	PF, t	J. M.S. G.m.b.H., Hamburg
Lubricoid	f	British Castors, Ltd., Birmingham, England
Lubritex	l, f	Gatke Corp., Chicago
Lucent Reel	PX, refined film scrap	Rex Campbell & Co., Ltd., England
Lucienit	PF, t	Kausch 282
Lucite	PX, f	du Pont Viscoloid Co., New York
Lugdomite	CA	Soc. Lyonnaise de Celluloide, Lyons, France
Lugias	SG, with resin interlayer	Röhm & Haas, A. G., Darmstadt, Germany; Sicherheitsglas, G.m.b.H. Kunzendorf, Germany
Lumarith	CA, m	Celluloid Corp., Newark, N.J.
Lumina	SG	Lumina Sicherheitsglas G.m.b.H., Wien
Luminite		Soc. la Luminite, Paris
Lumolit	Fiber board	O. Reinwald, Berlin-Wilmersdorf
Lupinit	C	Lupinit, G.m.b.H., Mannheim, Germany
Lusanite	Embossed CA, sheeting	British Celanese, Ltd., London W 1
Lustaware	f	Solidite & Synthetic Mouldings, Ltd., London, SW 4
Lusterioid		Silicocks Miller Co., South Orange, N. J.
Lustilac	m	Jos. Lucas, Ltd., Birmingham, England
Luxalin	PX, slow-burning	du Pont Viscoloid Co., New York
Luxalith, **Luxolith**	C	Soc. l'Oyonnaxienne, Oyonnax, France
Luxan	UF, s	Luxite Inc., Boston
Luxene	Resin denture PF	Bakelite Corp., New York
Luxite	PF, m, UF, m	Luxite Inc., Boston
Macoid	PX, dip finish	Crawford, MacGregor & Canby, Dayton, Ohio
Magramit	PF, l	Australia
Magnetpuls	f	Alfa-Laval-Separator, G.m.b.H., Berlin
Maisine	From cornmeal	Kausch 282
Maizewood	Synthetic lumber	Maizewood Products Corp., Dubuque, Iowa
Maizolith	Plastic from corn stalk	**RGMP 6**, 461, (1930)
Majestic	f	Bachman Bros., Philadelphia
Makalot	PF, s, m	Makalot Corp., Boston
Makelite	Cellulosic containers	American Can Co., New York
Maleaze	PF	**RGMP 6**, 157, (1932)
Mandem	f	McLeod & McLeod, London WC1
Manusolite	Cellulose plastic	Mfre. d'Isolants & Objets Moulés, Vitry-sur-Seine, France
Marbalin	PF (?)	Federal Cutlery Co., New York
Marbelle	f	Ebonestos Insulators, Ltd., London
Marblene	CA (?)	Waite & Son, Ltd., England
Marblette	PF, t	Marblette Corp., Long Island City, N. Y.
Marbloid		Waite & Son, Ltd., England
Marbolith	PF, t	Herold, A. G., Hamburg
Maresol		Dr. Kurt Albert, G.m.b.H., Amöneburg, Germany
Margolit	Cold molded	Ver. Isolatorenwerke, A. G., Berlin-Pankow, Germany
Marvelex	SG	England
Masa	PF, l, etc	Masa, G.m.b.H., Berlin
Masonite	Synthetic lumber	Masonite Corp., Chicago
Mastol	PF, s	Symentis Products, Ltd., Eccles, England
Mastolite	PF, l	
Masuron	CA, m, x	J. W. Masury & Sons, Brooklyn
M. E. C.	CA, f	Minerva Eng. Co., London SE17
Megohmax, **Megohmior**	Insulating materials	John Moores & Co. Salford, England
Megohmit	PF	**Plastics 6**, 705, (1930)
Meigsoid	Sugar-aniline	Meigsoid Corp., Jersey City, N. J.
Membranit		**Kunstst. 22**, 246, (1932)
Metakaline	PF	**RGMP 8**, 157, (1932)
Metduro	PF, t	Metduro, Ltd., London
Micafolium	PF	**Plastics 6**, 705, (1930)
Micalas, **Micanite**	Laminated mica	Soc. Francaise le Micalas, France; John Moores & Co., Salford, England
Micarta	PF, l, UF, l	Westinghouse Elect. & Mfg. Co., East Pittsburgh
Micolite	PF, m	E. H. Kellogg & Co., Paris
Mikalex	Mica-lead borate	Allgem. Elektrizitäts Ges., Berlin
Midgema	f	Midland Gear Case Co., Ltd., Birmingham, England
Mineralith	Inorganic	Blücher 224
Minotext	PF, m, asbestos filler	Mehdorn 18
Miralite		M. Toporowsky, St. Maur-des-Fosses, France
Mirament	Inorganic	Blücher 224
ML	UF, f	Beatl Sales Co., London
Modeloid	Modeling compd	L. Dreifuss Labs., San Francisco
Mokolite	C (?)	L. Laurin, Lunéville, France
Moldacele	CA, m	du Pont Viscoloid Co., New York
Moldarta	PF, m, UF, m	Westinghouse Elect. & Mfg. Co., East Pittsburgh
Moldite	CA	Am. Cellulose & Chem. Mfg. Co., New York
Monit	V	**Gummi-Ztg. 45**, 1242, (1931)
Monolite	Hot molded	General Electric Co., Pittsfield, Mass.
Moskalit	C	Moscow State Chem. Trust, Moskva
Motex	CA (?) goggles	Kirk Bros., London
Mouldensite	PF, m	Bakelite, Ltd., London
Moulding of Merit	f	Insulators, Ltd., Edmonton N., England
Mouldrite	PF, m	Croydon Mouldrite, Ltd., Croydon, England
Mowilith	Vinyl resins	I. G. Farbenindustrie, Frankfurt
Mprolite	f	Moulded Products, Ltd., Birmingham, England
Mycalex	Mica-lead borate	General Electric Co., Schenectady, N. Y.; Isolantite, Inc., Belleville, N. J.
Nacara	PX, x	Fiberloid Corp., Indian Orchard, Mass.
Nacrolaque	CA, pearl sheeting	Soc. des Usines Chim. Rhone-Poulenc, Paris; Jos. H. Meyer Bros., Brooklyn; Acetate Prods. Corp., Ltd., London EC4
Nally	f	Nally, Ltd., England
Nalo	V, sausage casing	Kalle & Co., Wiesbaden-Biebrich, Germany
Nameloid	CA, (?), x	Harold Mfg. Co., Ltd., Birmingham, England
N B	f	N B Mouldings, Ltd., London N 19
Necolastic	Cements	Imperial Chem. Industries, Ltd., London SW1
Negocoll	Modeling compd	Apotela, Ltd., Zürich, Switzerland
Neillite	m	Watertown Mfg., Co., Watertown, Conn.
Néocorne		G. Bonnard, Le Touvet, France
Neoformolit		Nastjukow, U. S. S. R.
Neoleukorit	PF	**Kunstst. 22**, 206, (1932)
Neolith	C	Deutsche Kunsthorn-Ges., Germany
Neophan, **Neophane**	CA, p	Cellonwerke, Charlottenburg, Germany; Transparent Paper, Ltd., Bury, England
Neophan-Neophan-glas	Windshields, etc	Deutsche Gasglühlicht-Auer-Ges., Berlin
Neoresit	PF, s PF, m	Aug. Nowack A. G., Bautzen, Germany
Nestorite	PF, m, PF, s	Jas. Ferguson & Sons, Ltd., London SW 19
Neo-Triplex	SG	Soc. du Verre Triplex, Paris
Neralia, **Nerane**		Soc. Rhodiaseta, Paris
Neutex	SG	Neutex Glaswerkstätten, G.m.b.H., Berlin-Charlottenburg
Nevalyte	f	Myers, Ltd., Walthamstow, England

Name	Description	Manufacturer or Reference
Neverbreak	f.	Baff Mfg. Co., North Arlington, N. J
Nevlle	Resins	Neville Chem. Co., Pittsburgh
Newtex	SG	Newtex Safety Glass Co., Ltd., London WC 2
New-Wrap	V, p	British "New-Wrap" Co. Ltd., Manchester, England
NIC	f.	Nicolle, Paris
Nidrose		L. C. V. Picquet, Oyonnax, France
Nie-Splitt	SG	Dewag Deutsche Warenvertriebs, G.m.b.H., Berlin-Schöneburg
Niger		M. Gaupillat, Paris
Nigrolith		**Kunstst. 22**, 176, (1932)
Niloid	PX	**Kausch** 283
Nixinoid	Gelatine plastic	Kausch 284
Nixonoid	PX, x	Nixon Nitration Works, Nixon, N. J.
Nobeline	PF, t	Soc. Nobel Francaise, Paris
Nonflamm	f.	Rheinische Gummi-& Celluloidfabrik, Mannheim, Germany
Norgine	Algine plastic	**Plastics 6**, 56, (1930)
Norloc	f.	Norton Labs. Co., Inc., Lockport, N. Y.
Nosplita	t.	Ambi-Verwaltung, Berlin-Johannesthal
Novelion	m	British Celanese, Ltd., London W 1
Noveloid	x cellulose derivs	Imperial Chem. Industries, Ltd., London SW1
Noveltic	PX, etc., f	K. F. Mayer, London EC 1
Novite	PF, m	Imperial Chem. Industries., Ltd., London SW 1
Novo-Heliophan	Gelatine foil	Gebr. Klotz, Göppingen, Germany
Novolak	PF, s	Bakelite Corp., New York
Novolithe	CA	Soc. Belignite, Belligna, France
Novotext	PF, l	**Bakelite Review**, Oct., 1931
Novoresit	m, resorcinol resin	Aug. Nowack, Bautzen, Germany
Nuplax	UF, (?)	American Nuplax Corp., New York
Nusal	PF, f	Williams & Laird, Methil, Scotland
Nymphrap	p	Sylvania Industrial Corp., Fredericksburg, Va.
Nypo	f.	John Walter & Sons, Ltd., Kitchener, Ontario
Oceline	Cellulosic plastic	Etabls. J. Paisseau, Paris
Oeser-Folien	Gold leaf substitute	**Pl M 2**, 75, (1932)
Olonite	CA, x	Soc. Ital. della Celluloide, Castiglione Olona, Italy
Omegite	PF, m	British Dyestuffs Corp., Ltd., Manchester, England
Omnilithe	C	Motende, Charente, France
Onazote		**Brit. Plast. 2**, 242, (1930)
Ondoine	PF, m	Soc. Anon. Francaise du Ferodo, Paris
Ondoita	PF, m	
Onduletta	f.	J. Jeidel, Berlin
Opal	See Ivoit	
Opalax	m, f	Crayonne, Ltd., Bexley England
Opalig		Soc. Rhodiaseta, Paris
Opalite		Soc. Anon. l'Ebenoid, Villeurbanne, France
Opax	Containers	Canadian Chem. Met. **17**, 131, (1933)
Ora		E. Bagge, Paris
Orba		L. Auerbach & Co., Fürth, Germany
Orfé	Sound records	Soc. Anon. Editions Phonedibel, Paris
Oriak	PF, f	Chance Bros. & Co. West Smethwick, England
Ornalith	PF, t	Herold, A. G., Hamburg
Orolith	CA	Soc. l'Oyonnaxienne, Oyonnax, France
Orolithe		
Orthospan	CA, x	Medical Supply Assn., Ltd., London WC 1
Ortlepp-Sportlepp	f.	Julius Ortlepp, Hamburg
Ortolan	Insulation	Gebr. Mayer, Esslingen, Germany
Osalith	C (?)	M. Geciaier, Ansbach, Germany
Ostolit	PF, m, s	Ostolit Corp., Winchester, Mass.
Oxygalalith	C	France
Oyocetil	CA	Soc. l'Oyonnaxienne, Oyonnax, France
Oyogalithe	C	
Oyonnithe	C	Soc. Petit-Collin-Oyonnithe, France
Pabcotite	Synthetic lumber	Paraffine Cos., Inc., San Francisco
Pacolite	f.	A. E. Patrick, Sydney, Australia
Palmersche Kunstholz	Albuminous binder, wood filler	Kausch 284
Pancelyte	PX, CA, f	Pan Britannica Industries, Ltd., London SW 1
Panelyte	PF, l	Panelyte Co., Trenton, N. J.
Panilax	Insulation	Micanite & Insulators Co., Ltd., London E 17
Panolite		I. Paenson & Cie., Paris
Panplastic	PF, t	American Plastics Corp., New York
Pantolit	PF, t	Augsburger Kunstharzfabrik, A. G., Augsburg, Germany
Panzerglas	German generic name for bullet-proof glass	
Papier Maché	Pressed paper	Hemming 221
Papyrolin	Laminated paper	**Kausch** 284
Papyrolith		Blücher 224
Papyroplast		**Brit. Plast. 2**, 323, (1930)
Papyrus	C	Jos. Nathan & Co., Ltd., London
Paracoumarone	Coumarone and /or indene	Barrett Co., New York
Paragalithe	C	O. Rabault, Paris
Paragutta	Rubber, gutta percha, wax	Bell Telephone Labs., New York City
Paralac	G, etc., resins	Imperial Chemical Industries, Ltd., London
Paranol	PF, s	Paramet Chem. Co., New York
Paralithe	t	Etabls. Kuhlmann, Paris
Parilithe		
Parfait	PX, denture	Parisien Chem. Co., Toledo, Ohio
Parsimon	Resins, etc	Vereinigte Stahlwerke, A. G., Düsseldorf, Germany
Parsolac	G, s	Ind. Finishing J. **3**, 189, (1932)
Pascelbex	Moiré sheeting	British Xylonite, Ltd., London E 4
Patentlack	Binder resin	L. Blumer, Zwickau, Germany
Paxolin	PF	Micanite & Insulators Co., Ltd., London E 17
Pearlite	CA (?) sheeting	Speights, Ltd., England
Pearloid	PX pearl sheeting	Joseph H. Meyer Bros., Brooklyn
Peerless	f.	Spill Mfg. Co., East Rutherford, N. J.
Pe Ha	f.	Presswerk, G.m.b.H., Herscheidt, Germany
Peka Glas	SG	Plötze & Kämpfer Berlin
P K Glas		
Pensulate	Insulation	Blackall Bros., Ltd., London E 15
Peralit	PF	**Plastics 6**, 705, (1930)
Perga-Packung	p	Wochenbl. f. Papierfab. **61**, 1344, (1930)
Permacel	f.	W. & G. Baird, Ltd., England
Perma-chrome	G	**Plastics 9**, 232, (1933)
Permali	PF, s	Le Bois Bakelisé, Nancy, France
Permaloid	PX, f	Celluloid Printers, Ltd., London SW 19
Permanite	PX, f	Parker Pen Co., Janesville, Wis.
Perma-plastic	PF	E. M. Wright, London EC 4
Permitol	Insulation	British Thomson-Houston Co., Ltd., London WC2
Pertinax	PF, l	Meirowsky & Co., A. G., Porz am Rhein, Germany
Pertinit	UF, f	
Phanocel	V sheeting	Cellophane Co., Ltd., Manchester, England
Phenac		Paint Oil Chem. Rev. **96**, 11, (1934)
Phenester	Synth. resin, coumarone type	Neville Co., Pittsburgh
Phenoid	PF, l	Mica Mfg. Co., Ltd., England
Phenolite	PF, l, UF, l	Natl. Vulcanized Fibre Co., Wilmington, Del.
Phibrolithoid	PX	Kausch 285
Philite	PF, m	N. V. Philips Gloeilampenfabrieken, Eindhoven, Netherlands
Phobophene		Westinghouse El. & Mfg. Co., East Pittsburgh
Phoenixite	PX	N. V. Philips Gloeilampenfabrieken, Eindhoven, Netherlands
Phonorfé	Sound records	Soc. Anon. Editions Phonedibel, Paris
Phonycord	PX, etc., f	Phonycord, G.m.b.H., Berlin
Picaroid	PX, coating process	Picaroid Processes, Ltd., London EC 2
Plasco	f.	Cie. Gén. des Matières Plastiques, Huningue, France
Plaskalite		**Plastics 8**, 442, (1932)
Plaskon	UF, m	Toledo Synthetic Products, Inc., Toledo, Ohio
Plass	UF, t	Pollopas, Ltd., Nottingham, England
Plastacele	CA, x, m	du Pont Viscoloid Co., New York
Plastam		Soc. Lilloise Plastam, Lille
Plastex		F. W. Royse & Co., Ltd., Manchester, England
Plastico		**RGMP 6**, 509, (1930)
Plastilina	Modeling wax	Kausch 285
Plastilume	CA (?) f	W. V. Hutchinson, London W 14
Plastine	CA, m	Soc. Nobel Francaise, Paris
Plastique	f.	Chanel, Paris
Plastit		**Kunstst. 5**, 204, (1915)
Plasto	Synthetic resin	Advance Solvents & Chem. Co., New York
Plast-o-crex	Synthetic resin	Rex Campbell & Co., Ltd., England
Plastone		Soc. la Plastone, Paris
Plastopal	UF, s	I. G. Farbenindustrie, Frankfurt
Plastophane	Mending tape	Johnson & Johnson, Ltd., Slough, England
Plastose	PF	Afcom, Ltd., London SW 9; Soc la Plastose, Paris
Plax	s	Plax Products, Ltd., London EC 4
Plexigum	Synthetic resin SG and interlayer	Röhm & Haas, A. G., Darmstadt, Germany
Plexite		
Plialite	Resin from rubber	Goodyear Tire & Rubber Co., Akron
Pliaphan	Gelatine foil	Langheck & Co., G.m.b.H., Esslingen, Germany
Plioform	m, resin from rubber	Goodyear Tire & Rubber Co., Akron
Plyafix	C	Jos. Nathan & Co., Ltd., London
Pollopas	UF, m, t, l	Venditor, G.m.b.H., Troisdorf, Germany Pollopas, Ltd., London EC 1 Etabls. Kuhlmann, Paris
Polyroc	t	Etabls. Kuhlmann, Paris
Porcedent	Vinyl (?) denture	
Porzelit	denture	
Posolite	Modeling compd	L. Dreifuss Labs., San Francisco
Presdwood	Synthetic lumber	Masonite Corp., Chicago
Pressmikanit	PF	**Plastics 6**, 705, (1930)
Preszspan	Gelatinized cellulose	Kausch 286
Presszell	PF	**Plastics 6**, 705, (1930)
Prestellan	Synthetic resins	Allgem. Elektrizitäts Ges., Berlin
Prestonite	Asbestos and binder	Kausch 286
Prestoplast	f	Vorwerk & Sohn, Wuppertal-Barmen, Germany
Prestware	f.	Prestware, Ltd., London SW 19
Prialithe	Talc, Mg silicate	
Prima Linoleum	See Triolin	
Primalithe	C, x	Cie. Francaise Plinatus, Paris
Priscal	UF, t	Soc. Anon des Matières Plastiques, Paris
Prisma	f.	Mica Mfg. Co., Ltd., England
Probo	PFl, f	L. Poulain, St.-Ouen, France
Progilac	Cellulose varnishes	Soc. Résines & Vernis Artificiels, Lyons & Paris
Progilite	PF, m, s	
Prophopla		Produits Photographiques & Plastiques, France
Prostine	PX	Kausch 286
Protectoid	CA, p	Celluloid Corp., Newark, N. J.
Proteolite	C	Industria Italiana della Proteolite, Milano
Proteyn	Denture material	
Protex	SG	Securex-Glas, G.m.b.H., Berlin-Schöneburg Protex Glass Co., New York
Protexane	CA, etc., p	British Celanese, Ltd., London W 1
Protexoid		
Prystal	UF, t	Soc. Nobel Francaise, Paris
Prystaline	UF, m	
Pyradiolin	PX, x slow-burning	du Pont Viscoloid Co., New York
Pyraheel	PX sheeting for heel covering	
Pyralin	PX, x	

Name	Description	Manufacturer or Reference
Pyrocel	f.	Shoreham Mfg. Co., Winfield, N. Y.
Pyroplax	Cold molded	Cutler-Hammer, Milwaukee, Wis.
Quakerlite	f.	General Mouldings Co., Ltd., London NW 1
Quick-over	Heat-setting shellacs	Wm. Zinsser & Co., New York
Radion	f.	Amer. Hard Rubber Co., New York
Radionite		Kausch 286
Radite	PX, f.	Sheaffer Pen Co., Fort Madison, Iowa
Rainbow Ware	UF, f.	Billmyre Mfg. Co., Ltd., London SE17
Ramaskit K	Textile waterproofing	**J. Text. Inst. 24**, A49, (1933)
Ramos	PF, f.	Universal El. Lamps Co., London EC 2
Rayolith	f.	**BPY** (1932)
Rayophane	V, p.	British "New-Wrap" Co., Ltd., Manchester, England
Redmanol	PF, m.	Bakelite Corp., New York
Refilite	m.	Dante Badino, Genova, Italy
Regalite		**Plastics 6**, 550, (1930)
Regedor		V. Planchon, Lyon
Regephane		
Reicolit	Insulation	Reicolit, G.m.b.H., Berlin
Reliance	PX, CA, f.	Reliance, Ltd., Twickenham, England
Repelit	PF, l.	Mehdorn 6
Repetit	PF.	**Plastics 6**, 705, (1930)
Resan	PF, t.	Kunstharzfabrik Resan,
Resanit	PF, t.	Mosbierbaum, Germany
Rescolite	PF, m, s.	Rescolite Corp., Newtonville, Mass.
Resin AH	Polystyrol	**CGP 28**, 15366, (1931)
Resin AW 1		
Resin AW 2		
Resin KM		Advance Solvents & Chem. Co., New York
Resinit	PF.	Knoll & Co., Ludwigshafen, Germany, Bakelit Ges., Berlin
Resinoid	f.	Etabls. Durrschmidt, Lyon
Resinol	PF, s, m.	Dr. F. Raschig, G.m.b.H. Ludwigshafen, Germany
Resinox	PF, m, s.	Resinox Corp., New York
Resin Superba	PF.	**Plastics 5**, 38, (1929)
Resin Superbo	PF.	
Resistan	Heat-resisting resins.	Römmler, A. G., Frankfurt
Resit	Generic name for polymerized PF resin.	
Resitex	l.	Robt. Bosch, A. G., Stuttgart, Germany
Resoglaz	Polystyrol	Advance Solvents & Chem. Co., New York City
Resol	Generic name for unpolymerized PF resin.	
Resopal	UF.	Römmler, A. G., Spremberg, Germany
Resovin	Vinyl resin denture	S. S. White Dental Mfg. Co., New York
Re-Sy-No		A. Poulverel, Paris
Revertex	Prepared latex.	Synth. Appl. Finishes 3, 133 (1933)
Revolite	Cloth impreg. with PF	Revolite Corp., New Brunswick, N. J.
Rexalith	C.	Soc. la Rexalith, Paris
Reynolite	f.	Reynolds Spring Co., Jackson, Mich.
Rezelite	PF.	Cussons, Sons & Co., Manchester, England
Rezinel	Synthetic resins	Glyco Products Co., Brooklyn
Rezyl	G, s.	American Cyanamid Co., New York
RhinoBoard	Gypsum board.	Gypsum Products, Ltd. Durban, Natal, So. Afr.
Rhodialine	CA sheeting	Soc. des Usines Chim. Rhone-Poulenc, Paris
Rhodialite	CA.	
Rhodiana		
Rhodite		
Rhodoid	CA, x, m.	
Rhodophane	CA, p.	
Rhoptix	CA for spectacle frames.	
Richelain	UF, f.	Richardson Co., Melrose Park, Ill.
Richware	PF (?)m.	Makalot Corp., Boston
Ricolit	Mise.	Süddeutschen Isolatorenwerke, G.m.b.H., Freiburg, Germany
Ripolin		**RGMP 8**, 319, (1932)
RJR	C, f.	Afcom, Ltd., London SW 1
Roalit	C (?).	K. Schwab, Nürnberg, Germany

Name	Description	Manufacturer or Reference
Roanoid	UF, f.	Roanoid, Ltd., Glasgow; Roanoid, Ltd., Melbourne
Roburine	m, natural resin base.	Mfre. d'Isolants & Objets Moulés, Vitry sur-Seine, France
Rockite	PF, m, s.	Rockhard Resins, Ltd., London W 1
Rockshell	PF, m.	
Rocrex	Synthetic resin s.	Rex Campbell & Co., Ltd., England
Rollistic	f.	Rolls Razor Co., London NW 2
Romalite		Kausch 287
Ronilac	UF (for injection molding)	Soc. Anon. la Ronite, Rosny-sous-Bois, France
Ronisol	PF (for injection molding)	
Ronite	m (for injection molding)	
Rosene	f.	Cascelloid, Ltd., England
Roxon	PF, f.	Roxon, Ltd., London EC 4
Rubba-Glas	Sugar plastic	Industrial Sugar Products Corp., New York
Rucel	Rubber-cellulose	**Brit. Plast. 2**, 294 (1930)
Rudex	PF.	Soc. Dorex, Paris
Runerit	PF, m, l.	Elektro-Isolier-Industrie G.m.b.H., Wahn, Rheinland
Ryertex	PF, l.	Jos. T. Ryerson
Sada		Etabls. J. Paisseau, Paris
Safetee Glass	SG.	Safetee Glass Co., Wissinoming, Pa.
Safetex	SG ‡	Safety Safetex Glass Co., London SW 1
Safetyware	f.	Bryant Electric Co., Bridgeport, Conn.
St. Bernard	f.	A. W. Kanis, London EC 1
Sak-a-lac	Sugar resin, soluble	Industrial Sugar Products Corp., New York
Sakaloid	Sugar plastic	
Sak-a-tex	p.	
Salva-Glas	SG.	Securex-Glas, G.m.b.H., Berlin-Schöneburg
Samson Celluloid	PX.	Celluloid Corp., Newark, N. J.
Sanophon	f.	Osonol Labs., London EC 1
Satolite	From soy bean casein	Sankyo Kabushiki Kaisha, Tokyo
Schellan	UF, s ‡	Kunstharzfabrik Dr. Fritz Pollak, Wien
Schellit	PF, t, ‡	
Scotoloc	f.	McGeoch & Co., Glasgow
Securex	SG.	Securit-Glas, G.m.b.H., Berlin-Schöneberg
Sécurit	SG ("hardened" glass, no interlayer)	Cies. réunies des Glaces de St. Gobain, Paris
Sekurit		Bicheroux & Cie., G.m.b.H., Herzogenrath, Germany
Sécurite	CA.	Cie. du Celluloïde Petit-Collin-Oyonnithe, Paris
Seekay	Chlorinated naphthalene.	
Seracelle	V, p.	Courtaulds, Ltd., London, EC 1
Sétabonite	Rubber & resin.	Mfre. d'Isolants & Objets Moulés, Vitry-sur-Seine, France
Sétacégéite	PF, m.	
Shallorite	Sound records	
Shawlac	Hot molded	Hemming 179
Shellit	t.	Kesslers, Ltd., London EC 1
Shellware	f.	General Mouldings Co., Ltd., London NW 1
S. I. A. P.	f.	Soc. Ind. d'Application Plastique, Montreuil sous Bois, France
Sibolit	Synthetic resin s.	
Sibor	SG.	Soc. Verreries de Folembray, Folembray, France
Sicalite	C.	Soc. Nobel Francaise, London EC 1
Sicalite N		
Sicoid	CA.	Soc. Ind. du Celluloïde, Paris
Sidac	V, p.	Soc. Ind. de la Cellulose, Ghent
Sidac-Isol		British Sidac, Ltd., England
Sigaleos	PF.	Italy
Sigla	SG.	Sicherheitsglas, G.m.b.H. Kunzendorf, Germany
Sigla-Glas		
Silasit	Tank lining	Z. Ver. deutsch. Ing. 78, 16, (1934)
Silverloid	f.	Silverloid Co., Providence, R. I.
Simco	f.	Silicocks Miller Co., South Orange, N. J.
Similac		L. C. F. Pechin, Bois-Colombes, France
Similex	PF, t.	Labs. Industriels d'Asnières, Paris
Similit	PF.	
Similithe	C, f.	Lagulonie & Cie, Paris
Similoid	CA.	Soc. Ind. des Matières Plastiques, Paris
Simplex	SG.	Soc. du Verre de Sûreté Simplex
Sinur	CA.	Kausch 288
Siola	f.	A. M. Hughes, London NW 6
Sipilite	PF.	Kausch 288

Name	Description	Manufacturer or Reference
SNF	f.	Soc. Nobel Francaise, Paris
Solidite	f.	Solidite & Synthetic Mouldings, Ltd., London SW 4
Solith	PF, t.	Kunstharzfabrik Regal & Co., A. G., Praha
Soprolith		Soc. des Produits Tanandois Soprotan, Paris
Souvelo	f.	Souvenir Mfg., Co., Ltd., Birmingham, England
Spauldite	PF 1.	Spaulding Fibre Co., Tonawanda, N. Y.
Splintex	SG.	Splintex Safety Glass Co., London EC 3; Soc. du Verre de Sûreté Splintex, Penchot, France; Splintex Belge, Bruxelles
Sportsman	f.	A. W. Kanis, London EC 1
Stabilite	Hard rubber dielectric	Mfre. d'Isolants & Objets Moulés, Vitry-sur-Seine, France
Stacol	Water-sol. resin.	Glyco Products Co., Brooklyn
Stanax	Denture.	
Stapp		Soc. pour Transformation & Application des Produits Plastiques, Paris
Starite		**Plastics 3**, 299, (1927)
Starkware	UF, (?), f.	
Starlite	Synthetic resin	Soc. Gén. de Constr. Electro-Mécanique, Limoges
Starpass	UF.	
Sterilin	Surgical tissue.	Germany
Stoco	Bituminous plastic	Jos. Stokes Rubber Co., Ltd., Welland, Ontario
Streetly	UF, f.	Streetly Mfg. Co., Ltd., London
Suberit	PX.	Kausch 288
Super-Beckacite	PF, s.	Beck, Koller & Co., Detroit & Wien
Superex	CA, m, denture.	Alcolite, Inc., Philadelphia
Superisolite	PF.	Italy
Superlit	Synthetic resin.	Dr. Stein, Berlin
Super-micanite	Mica bonded with G.	
Super Pertinax		**PIM 4**, 70, (1934)
Supertex	SG.	Supertex Safety Glass Co., London
Syiphrap	p.	Sylvania Industrial Corp., Fredericksburg, Va.
Sylphseal	Bottle caps	
Sylvania	V, p.	
Symentis	Plastic binder.	Symentis Products. Ltd., Salford, England
Synobel	Cements.	Imperial Chemical Industries, Ltd., London SW 1
Syn-phorm	Synthetic resin.	Blackburn & Oliver, England
Synplas	f.	G. N. Higgs, London W 11
Synthaform	PF, etc., f.	Synthaform, Berlin
Synthane	PF, l.	Synthane Corp., Oaks, Pa.
Syntholite	PF, (?) ‡.	Soc. Anon, la Syntholite Paris
Syrolit	C.	Aktiebolaget Syrolit, Eslöf, Sweden
Tantoid	m.	W. T. Tant & Co., Ltd., England
Tapa	f.	W. J. Charlesworth, Ltd., Birmingham, England
Taumalit	PF, f.	Isopresswerk, Berlin
Taylor	PF, l.	Taylor & Co., Norristown, Pa.
Teglac	Synthetic resin, s.	American Cyanamid Co., New York
Tego	Synthetic resin, s.	Th. Goldschmidt, A. G., Essen, Ruhr
Tegofan	Chlorinated rubber.	
Tegopren	Synthetic resin	
Teguwa	f.	Teguwa, G.m.b.H., Wuppertal-Barmen, Germany
Telconax	Bituminous plastic	Telegraph Constr. & Maintnce. Co., Ltd., London EC 2
Telenduron	Insulators & m.	Thos. de la Rue & Co. Ltd., London
Templus	f.	Bryant Electric Co., Bridgeport, Conn.
Tempo	Cellulose esters.	Tempo, G.m.b.H., Berlin-Wilmersdorf
Tenacit	See Tenazit	
Tenalan	PF.	**Plastics 6**, 705, (1930)
Tenatext	PF, rag-filled, m.	Allgem. Elektrisität Ges., Berlin
Tenazit	PF, m.	
Tenegrine		Soc. Rhodiaseta, Paris
Tenite	CA, m.	Tennessee Eastman Corp., Kingsport, Tenn.
Tensulam	m.	Berry Wiggins & Co., Ltd., England
Teolit	m.	E. Hedfeld, Kierspe, Germany

Name	Description	Manufacturer or Reference
Tepperite	Polystyrol denture	Martin Rubber Co., Long Island City, N. Y.
Tetrolith		Kunsthornwerke Teterow, Mecklenburg-Schwerin
Textal	V, p, coated aluminum foil	Aluminium Walzwerke, A. G., Singen, Germany
Textiline		E. Eynard, Lyons
Textit	f, acid-proof moldings	Cable Mfg., Co., Ltd., England
Textolite	PF, m, PF, l	General Electric Co., Schenectady, N. Y.
Text-Tiles	UF, (?), tiles	Kelacoma, Ltd., Welwyn Garden City, England
Thermasote	Fiber board	Agasote Millboard Co., Trenton, N. J.
Thermica		Jaroslaw's Erste Glimmerwarenfabrik, Berlin
Thermolite	PX, denture	
Thermoplax	Cold molded	Cutler-Hammer Mfg. Co., Milwaukee, Wis.
Thermose	Benzyl cellulose denture	Bakelite Dental Supplies, London
Thesit Supra; Thasit Textil	m; l	Presswerk, A. G., Essen, Ruhr
Thickol	Polymethylene polysulphide	Brit. Plast. 4, 440, (1933)
Thiobonite; Thiojectite	Thiolite & ebonite for injection molding	Soc. la Thiolite, Joinville-le-Pont, France
Thiokol	Olefine polysulphide	Thiokol Corp., Yardville N. J.
Thiolite	PF, treated with sulphur chloride	Soc. la Thiolite, Joinville-le-Pont, France
Thomasit	C	Kausch 289
Thorax	SG	Mühlig Union, Praha
Thyrite		General Electric Co., Schenectady, N. Y.
Tocolit	PX	Tocolit, A. G., Alterlaa, Austria
Tomofan; Tomophan	V p	Tomaszow, Poland
Torgament		Blücher 224
Tornesit	Chlorinated rubber	Herold, A. G., Hamburg; Hercules Powder Co., Wilmington, Del.
Tornesit	Cellulose derivative	Farbe u. Lack, 390 (1930)
Tortalette	CA, f	H. Goodman & Sons, Inc., New York
Tortaloid	CA, f	Fiberloid Corp., Indian Orchard, Mass.
Traffolyte	l	Metropolitan-Vickers, London, WC 2
Transcetic	p	Plastics 7, 619, (1931)
Transflex	Gelatine sheeting	Central Import Co., Chicago
Transparenta	CA, p	Transparenta G.m.b.H., Berlin
Transparit	V, p	Wolff & Co., Walsrode, Germany
Transphan	cuprammonium cellulose foil	Bemberg, A.G., Wuppertal, Germany
Trefoil	PF	Bakelite Ltd., London SW1
Trelit	PX	Norway
Treugolnik	f	Soc. Francaise Treugolnik, Paris
Triacel	CA, p	Chem. Weekblad 29, 167 (1932)
Triangle	f	Soc. Francaise Treugolnik, Paris
Trilob	SG	Cie. Int. pour la Fabr. Mécanique du Verre, Bruxelles
Triolin	PX, floor covering	
Triplex	SG	Triplex Safety Glass Co., Ltd., London; Soc. du Verre Triplex, Paris
Triplex Toughened	SG (hardened glass, no interlayer)	Triplex Safety Glass Co., Ltd., London
Triunghiul	f	Soc. Francaise Treugolnik, Paris
Trojkat	f	
Trolit F	PX, x non-inflammable	
Trolit W	CA, m	
Trolit-Spezial	‡See Trolitan.	
Trolit Spritzguss-masse	CA, for injection molding	
Trolitan	PF, m	
Trolitan H.	‡(same as Poliopas)	Dynamit A.G., Troisdorf, Germany
Trolitan-Profile	Continuous moldedshapes	Venditor Kunststoff-Verkaufsges, m.b.H., Troisdorf, Germany
Trolitan Z	PF, m in light colors‡	
Trolitax	PF, l	
Trolitul	Polystyrol m	
Trolitul-folien		
Trolon		
Trolon-Platten	PF, t	
Troluloid	Vinyl resin‡	
Truesound	Sound records	British Xylonite Co. London, E4
Tubize	Artif. silk (collodion process)	Tubize Chatillon Corp., New York
Tufnol	PF, l	Ellison Insulations, Ltd., Birmingham, England
Turax	PF	Plastics 6, 705, (1930)
Turbax	PF, l	Jaroslaw's erste Glimmer-Waren-Fabrik, Berlin-Weissensee
Turbomic; Turbonit	PF, ml	Jaroslaw's erste Glimmer-Waren-Fabrik, Berlin-Weissensee
Tusko Board	Gypsum board	W. F. Johnstone & Co., Johannesburg, Transvaal
Tylose	S, methyl cellulose	Chem. Markets 31, 48, (1932)
Tyrex	SG	Tyrex Safety Glass Co., San Francisco
Ultraphan	CA, p	Lonza Werke, Weil-am-Rhein, Germany
Ultrasit	PF, t	Ambrasit Werke, G.m.b.H., Wien
Ultrastrip	f	Troughton & Young, Ltd., London SW1
Umbraced	Coated netting	Haver & Boecker, Oelde, Germany
Unex	SG ("hardened glass")	Unex Single Sheet Safety Glass Co., Ltd., London SW1
Unyte	UF, m	Unyte Corp., New York
Uralite	UF, m; UF f	Soc. Résines et Vernis Artificiels, Paris; American Record Co., Scranton, Pa.
Urelt	Generic term for Resit for PF	UF resins, analogous to
Urocristal	UF, m transparent	Fabriques de Laire, Issy, France
Urophane	UF, m transparent	Soc. Résines et Vernis Artificiels, Paris
Utilit	PF, t	Augsburger Kunstharz-Fabrik, Augsburg, Germany
Utilitape	Waterproof tape	Revolite Corp., New Brunswick, N. J.
Utiloid	CA, in powder form	James Hind, London N16
Varcrex	Synthetic resin	Rex Campbell & Co., Ltd., England
Varcum	PF, s	Varcum Chem. Corp., Niagara Falls, N. Y.
Vegetalin	Parchmentized cellulose	Kausch 289
Velos	f	Frank Pitchford & Co., Ltd., London EC1
Velskin	Lampshade material	Albion Shades, Ltd., England
Venite	PX, f	Bluemel Bros., Ltd., Wolston, England
Veracetex	SG	Glaceries Réunies, Bruxelles
Vergalite	Cx	Soc. Nobel Francaise, Paris
Verolith	C (?)	Verolith, G.m.b.H., Naumberg, Germany
Verre Organique; Verre Synthetique		Mme. Lacroux, Bois-Colombes, France
Verre Plastique	f	A. Rousult, La Garenne-Colombes, France
Veryx	UF	Edgard Israel, France
Viaconit	m	Vereinigte Isolatorenwerke, A.G., Berlin-Pankow, Germany
Victron	Polystyrol, m	Naugatuck Chem. Co., Naugatuck, Conn.
Vigorit	PF, t	Dr. F. Raschig G.m.b.H., Ludwigshafen, Germany
Vimilite	CA, coated netting	Plastics 9, 232, (1933)
Vinnapas	Vinyl resin	Consortium für Elektrochemische Industrie G.m.b.H., Germany
Vinsol	Synthetic resin, s	Hercules Powder Co., Wilmington, Del.
Vinylite	Vinyl resin, m	Carbide & Carbon Chem. Co., New York
Vio-Ray	Coated netting	Vio-Ray Co., Kansas City, Mo.
Viralite	CA, coated netting	Darlington Fencing Co., Ltd., London EC4
Vis	SG	Vetro Italiano di Sicurezza S.A., Pisa, Italy
Visca; Viscacelle	V; Vp	Courtaulds Ltd., London
Viscafoil	V, etc., p	Holmes & Kingcombe, Glasgow
Visco	V, p	Chem. Werke Visco, Ausstg. Czechoslovakia
Viscoid		Kunstst. 22, 169, (1932)
Viscoloid	PX, x	du Pont Viscoloid Co., New York
Visking	V, sausage casing	Visking Corp., Chicago
Vitalite	"Flexible glass"	New York Wire Cloth Co., New York
Vitorit	See Vitrex	
Vitreo-Colloid	CA, sheeting, bottle caps	Provincial & Foreign Investments, Ltd., Oxted England
Vitrex	CA, coated netting	Transparentfolien, 284
Vitrocelle	V, p	Dalle Frères & Lecomte, Bousbecque, France
Vitrolac	Sound records of vinyl resin	RCA-Victor Corp., Camden, N. J.
Vitroloid	Lampshade matl	Albion Shades, Ltd., England
Vitrolux	Cellulosic panes	W. & G. Baird, Ltd., England
Volprufe	Insulation	Faire Bros. & Co., Ltd., Leicester, England
Vulcabestos		Hemming 179
Vulcoid	PF, l, using vulcanized fiber	Continental-Diamond Fibre Co., East Newark, Del.
Vydon	Vinyl resin denture	Lee S. Smith & Son, Pittsburgh
Wacker shellac	Modified shellac	S & S 266
Wahnerit	PF, l	Elektro-Isolier-Industrie, m.b.H., Wahn, Germany
Waldesit	PX, etc., f	Waldes & Co., Dresden
Walkerit	PF, denture	
Walo-Kapseln	V, bottle caps	Wolff & Co., Walsrode, Germany
Walonerit	m	Elektro-Isolier-Industrie, m.b.H., Wahn, Germany
Wandrite	PF	H. Wandrowsky, Berlin
Waterlite	Polystyrol	Watertown Mfg. Co., Watertown, N. Y.
Wenjazit	PF, t	Kunst-Rohstoff A. G., Hamburg
Westbury Ware	f	Reliance Mfg. Co., Ltd., England
Wistal	m	Presswerk, A. G., Essen, Germany
Xantholith	PF, etc., ‡	Cie. Francaise Pilnatus, Paris
Xenit	f	Cellulose Compositions Co., Ltd., London SW
Xetal	SG	Xetal Safety Glass Co., Ltd., Stapleford, England
Xilite	PF, t	Plastics 6, 589, (1930)
Xylamil	PX, slow-burning	Bonwitt
Xylolith	Flooring matl	Deutsche Xylolith Platten, Fabrik, Germany
Xylonite	PX, x	British Xylonite Co., Ltd., London E4
Xylose	Benzyl cellulose denture	Bakelite Dental Supplies, London N 3
Yeophane		M. Musone, Paris
Yunos	PF, f	Universal Electric Lamp Co., London EC 2
Ys	f	Henry Howell & Co., London
Zalmite	For molding furniture	Simmons Co., Kenosha, Wis.
Zeliglas	V, p	Germany
Zellhaut	p	Chem. Fabr. von Heyden A. G., Dresden
Zelith	See Celit	
Zelon	See Celon	
Zellugol	CA	Kunstst. 21, 87, (1931)
Zellwonet	V, p	Wolf Netter, Ludwigshafen, Germany
Zoolite	C	Soc. Polenghi Lombardo, Codogno, Italy
Zyl	Sponsored by Plastics 3, 265, (1927)), as generic name for PX, x	
Zyloware	f	Zyloware Corp., New York
	C	Sarvis Osakeyhtio, Tammerfors, Finland
	CA, p	A. S. Datra, Denmark
	CA, sound records	Soc. Ultraphone, Paris
	CA	Fabbrica Ital. Materia Coloranti Bonelli, Cesano Maderno, Italy
	Magnesite, m	M. E. Converse & Son Co., Winchendon, Mass.
	PF	Magnasco Roggero & Co., Genova
	PF	Fabryka Kabli, Krakov; Poland
	SG	Ford Motor Co., Detroit
	SG	Laminated Glass Mfg. Co., Detroit & Windsor, Ontario
	Creaseless textiles	Tootal, Broadhurst, Lee Co., Ltd., Glossop England

Technical Sessions of A.I.Ch.E. Feature Aluminum

EDITORIAL STAFF REPORT

ALL TECHNICAL SESSIONS of the meeting of the American Institute of Chemical Engineers, held in the Hotel Schenley in Pittsburgh, November 15, 16 and 17, centered largely around the symposia on applied chemical engineering subjects. Several of the papers appear in full elsewhere in this number of *Chem. & Met.*, while abstracts of others are given in the following paragraphs. An account of the annual business meeting and other features of the convention will appear in December.

Advantages and disadvantages of using aluminum in process industries were discussed by Dr. Francis C. Frary, director of research for the Aluminum Co. of America. The principal advantages of aluminum center around its resistance to corrosion by certain chemicals and the character of the corrosion products formed. While the metal *per se* is very active chemically, it is always (except when amalgamated) covered with a thin, adherent, naturally formed coating of its oxide. This is very inert chemically and quite insoluble in some reagents; particularly most organic liquids, distilled water and many organic acids. For certain purposes, it is advantageous to produce a thicker oxide coat by anodic treatment in suitable solutions and improve the impermeability of the oxide coating by "sealing" treatments, or impregnate the coating with corrosion-inhibiting substances. In other cases, as, for example, where brine is the corroding agent, special alloys are found to be much more resistant than pure aluminum, and sometimes it is possible to add corrosion inhibitors, such as bichromate, to the brine without interfering with the process. In most cases, however, the corrosion resistance of aluminum in acid or neutral solutions increases rapidly as the purity of the metal increases. Broadly speaking, magnesium, manganese, chromium, and possibly antimony are the only alloying elements commonly added to aluminum which do not reduce its corrosion resistance to most chemicals.

Aluminum articles may be broadly divided into two groups—wrought and cast. In general, an alloy suitable for wrought objects is not used for castings, and vice versa. Pure aluminum is practically always used in the wrought form, as it is difficult to cast into any but the very simplest shapes (ingots). Because of the crystallization shrinkage, it is difficult to produce any large castings of moderate to thin wall thickness which will be completely non-porous and impermeable to liquids and gases under pressure. For this reason, equipment for treating liquids or gases under pressure should generally be designed to be made of wrought metal wherever possible. Small simple castings like pipe fittings, however, can be made tight with the proper technique and the use of certain alloys, and are regularly made and used for such work. Castings may also be used for apparatus where there is no pressure difference to be withstood, as for bubble caps in an oil still, and the like.

The ease with which aluminum may be given special shapes by drawing, hammering, forging or extrusion makes it practicable to produce almost any piece of equipment in the wrought metal. Most such equipment for the chemical industry is made of either commercially pure aluminum (2S) or an alloy containing about 1.25 per cent manganese (3S), or one containing 1.25 per cent magnesium and 0.7 per cent silicon (53S) because these are the most resistant, in general, to corrosion. For salt solutions, however, a new alloy (52S) containing a small quantity of magnesium has shown a greater resistance than even pure aluminum, and with a casting alloy of a related composition (214) will probably give the best results obtainable with aluminum alloys. Pure aluminum is the weakest and 53S is the strongest of the alloys just mentioned. The latter alloy is strong enough so that commercial beer barrels made of it withstand a pressure of 500 lb. per sq. in.

The chemical engineer is to a large extent concerned with two problems in the field of electrical insulation, namely, the development of new materials with specific electrical properties and their manufacture. This was stated by C. F. Hill of the Westinghouse Electric & Manufacturing Co. in his paper on some polar characteristics of electrical insulation. The engineer will, therefore, be particularly interested in a new phase of dipole studies in dielectrics which is attracting considerable attention at present, and which appears to be gaining in practical as well as fundamental importance. This paper proposes especially to call attention to the fact that this phenomenon of dipole structure may be found of importance in solids as well as liquids and gases. Polar molecules were discovered, of course, in gases or vapors and it was not expected that they could be detected in solids. As a matter of fact their behavior in viscous liquids was somewhat unexpected, and the cases for solids given are attracting considerable attention and discussion.

Photography in Research

Dr. Walter Clark, assistant to the director of research of the Kodak Research Laboratories, presented a description of the uses of photography in chemical engineering research. Dr. Clark confined his paper to a few of the interesting cases in which photography is providing a simple way of aiding the scientist in problems which demand a high degree of special skill and knowledge, and a full understanding of the properties of photographic materials.

The paper on refractories and their applications, by W. F. Rochow of Harbison-Walker Refractories Co., and the paper on heat transmission through bare and insulated furnace walls, by R. H. Heilman, of Mellon Institute of Industrial Research, will be published in the December number of *Chem. & Met.*

Among the other papers presented are: heat transfer and pressure drop data for an oil in a copper tube, by J. F. Downie Smith, Harvard Engineering School; quantitative evaluation of mixing as the result of agitation in liquid-solid systems, by A. W. Hixson and A. H. Tenney, department of chemical engineering, Columbia University; the enthalpy concentration chart—a useful device for chemical engineering calculations: part 1—applications, part 2—theory and construction of chart for solutions of sodium hydroxide in water, by Warren L. McCabe, University of Michigan.

Reader's VIEWS AND COMMENTS

Slaked Lime—Hydrate of Confusion

EDITOR'S NOTE: Evidently there are others who think, as was expressed editorially in *Chem. and Met.* recently, that lime is a real problem of chemical engineering concern. Four of our experienced readers give us quite diverse points of view—enough to show that the industry still has much to accomplish in smoothing out problems of efficient utilization of hydrate.

To the Editor of Chem. & Met.:

Sir—The lime companies that I have come in contact with are as a rule quite careful in the preparation of their product. Since we are in a high calcium district, most of the lime produced in the Mississippi Valley is used by the chemical industry. The building trades naturally like a dolomitic lime and most of it comes from Ohio. It seems to be more plastic and smoother under the trowel. This district has difficulty in competing with magnesium lime for construction purposes.

Therefore, we bear down on purity and definite chemical composition. Some of the chemical manufacturers specify "less than 0.009 per cent phosphorus"; others "not more than one part per million arsenic;" others "less than 0.40 per cent silica" others "not less than 97 per cent available calcium hydroxide," etc. And we meet these specifications.

The physical properties are quite another thing. There is a lot the lime manufacturer can learn about them, but there doesn't seem to be much he can do about them. The physical nature of lime seems to be influenced largely by the limestone from which it is manufactured. Some features may be controlled slightly by the method of burning, but on the whole, much work needs to be done to determine whether the natural physical characteristics of a lime can be changed by plant manipulation.

There is another angle to this problem. We have found a tremendous lack of lime knowledge, shall I say, among lime users. I have seen this especially among the paper-mill superintendents. Just recently, I had occasion to visit two paper mills in Wisconsin that were complaining about the lime from one of my clients. One superintendent said that the lime settled too quickly in his causticizing tank. The other paper mill superintendent criticized the same lime because it settled too slowly in his causticizing tanks. These two paper-mill superintendents were getting the same settling rate from the same lime, but one thought it was too fast and the other thought it was too slow. It so happens that the chief chemist of each plant told me that the lime was perfectly all right. So there you are!

Another experience with a paper mill. The mill complained that the lime from one of my clients contained such a quantity of coal ash and cinder that the lime could not be used for the purpose intended. Since they were using lime in the manufacture of a filler for white paper it can be readily seen that any black spots could be decidedly detrimental. Every effort was made to remove all black spots but the complaint continued. This lime was made in a plant using coal as a fuel. Several cars were now purchased from a plant in the immediate neighborhood that was burning with gas. The paper mill still complained there was too much coal ash and cinder in the product. So there you are again!

One man complains about the lime being burned too hard; another firm says that it isn't burned hard enough. So as you have so succinctly stated in your editorial, slaked lime is truly the hydrate of confusion, and I may add, quick lime also adds to the confusion, and while we are at it, let's add limestone too.

I will grant that there are many justifiable criticisms in connection with the quality of lime, but I will say that many complaints are not founded upon fact. There are so many elements entering into this subject that we could not cover them in many letters. The user in many instances is prejudiced in favor of the lime that he was raised with. There is no objection to that if he is honest in his opinion. Many times, however, the complaint is not an honest one for the superintendent or purchasing agent is, I am sorry to say, still occasionally influenced by personal contacts of a mercenary nature.

A careful study of the whole situation along the lines you have intimated would probably produce some valuable results but I still believe that the physical nature of lime is inherently associated with the nature of the stone from which it is produced. The lime man can burn the lime under the best conditions and inspect it carefully before shipping and hope that the consumer will find it satisfactory. I know of a number of instances where the producer thought he had changed the physical properties of his product but in every case experience taught that nothing of a material nature had been accomplished.

H. E. WIEDEMANN
Consulting Chemist,
Chemical Building,
St. Louis, Mo.

To the Editor of Chem. & Met.:

Sir—In regard to the question about slaked lime raised in your editorial in September, I feel that most of the difficulties arise in the quality of the unslaked lime material. There are many possible variations. Those that appear to be most significant are the physical nature and the degree to which slaking has occurred on the surface of the particles. Lime that is partially slaked before it is converted into a slurry tends to give trouble in the production of slurries of uniform composition. It seems to me that the first problem to solve is that of reducing the lime to such a physical state that it will hydrate uniformly when put into water. Also, it is important that the manufacturers of lime study the problem of protecting it from gradual slaking in the barrels.

M. L. CROSSLEY
Chief Chemist,
The Calco Chemical Co., Inc.,
Bound Brook, N. J.

To the Editor of Chem. & Met.:

Sir—We are fairly new as users of this material, but are now consuming from 75 to 100 tons per day of lime, all of which is hydrated at our plant. We have experienced no particular trouble or confusion, and to that extent are somewhat puzzled as to just what was in the mind of the editorial writer in preparing his discussion.

Lime is an exceedingly cheap commodity, and one which has been made for generations all over the country, using various types of equipment, and limestones of various compositions and properties. It must continue to be made at various localities, because it cannot stand a high freight rate. So long as this condition exists, it cannot be ex-

pected that all lime made will be uniform in composition and physical properties. Certainly, it would be unreasonable to attempt to force every lime manufacturer in the country to install the most modern type of burning equipment of some specific design. Present equipment in most cases is producing a reasonably satisfactory product to meet the demands of the customer to whom it is going, but the lime from one manufacturer will differ widely from that obtained from another manufacturer, because their equipment and process are not identical. On the other hand, it is perfectly possible to get a uniform grade of lime at all times by standardizing on the product of a single manufacturer. This involves no great hardship, because competition is such that the prices are fairly well standardized.

We have used lime from three or four different sources and from widely separated parts of the country. We have obtained a fair idea as to the limitations and merits of the several manufacturers, and we do not expect to obtain the same grade of lime from a manufacturer using shaft kilns in Indiana, and a manufacturer using rotary kilns in Virginia. They are not uniform in their slaking properties, in their calcium oxide content, nor in their content of inert material. We believe it unreasonable to expect such uniformity as between two different manufacturers, and if we require absolute uniformity, we would standardize on the product of a certain mill and require strict uniformity in the product shipped to us from that mill, which is always possible to attain.

We have been able to modify our method of operation to accommodate a wide variety of lime, and are inclined to think that it would be unreasonable to expect lime from all sources to be uniform in composition and physical properties.

J. N. Compton
Chemical Engineer,
Carbide & Carbon Chemicals Corporation,
South Charleston, W. Va.

To the Editor of Chem. & Met.:

Sir—Your editorial on "Slaked Lime, Hydrate of Confusion" is very timely. The lime industry needs it. I hope it will awaken the industries to the necessity for thorough fundamental research work on lime.

Unfortunately, most of the technical work on lime has been done for the purpose of displacing something else with it. The demand has been to translate research results into sales promotion almost immediately. No substantial progress can be made until that point of view is given up. A five-year research program should be financed and put under the direction of thoroughly reliable directors fully trained in chemistry and experienced in the study and use of lime. If such an organization could be left alone for a period of five years, I am convinced they would produce results of tremendous value to the lime industry.

Lime is a complex, mysterious material. Very little is known about its intrinsic properties and the means of altering and controlling these properties. Why is it that finishing hydrate can be made from some limestone and not from others? Why is it that some burnt lime slakes with explosive violence and others slake with great resistance? Why is it that some limes carbonate readily and others less readily when used as plasters? These fundamental questions could be added to almost indefinitely. Of course we have some superficial information on all of these problems, but no one has ever had a real opportunity to get at the really essential, fundamental facts. We know most of what we might want to know about such a chemical material as sulphuric acid. There is nothing very mysterious about the manufacture of the acid or its properties. In striking contrast, however, is our limited and inadequate information about lime. Surely lime is an important enough material to justify our knowing as completely about it as we do about sulphuric acid.

M. E. Holmes
Dean, New York State College of Ceramics,
Alfred University,
Alfred, N. Y.

Acetic Acid vs. Calcium Acetate

Editor's Note: Professor Othmer presents a very interesting comment which rightly commends chemical-engineering development rather than mere abandonment of an industry which has suffered from unchecked obsolescence. Recalculation on the conditions in the wood-distillation industry inclines us to retain our earlier view that not more than a few—we would say not over 4 or 5—plants in this industry can afford the new capital *and the required skilled supervision* for a direct recovery acetic acid unit. We shall know more about the facts on which such a conclusion will ultimately be based when Dr. Othmer's interesting new plant in Pennsylvania has operated for a time and actual experience is thus to be had. We hope he is right that a generous number of other such units are economically feasible.

To the Editor of Chem. & Met:

Sir—The editorial in your September issue, "Further Processing for Calcium Acetate," is certainly correct in the hypothesis that "Chemical Industry finds the purchase and use of acetic acid generally more convenient than the starting of operations with calcium acetate." If proof is needed, there is plenty available in the tremendous stocks of calcium acetate now held by every producer.

The argument from this first premise is, I believe however, unsound from two standpoints: viz., (1) The most modern plant for direct acetic can be economically installed—and paid for out of earnings in one or two years—in even the smallest unit. (2) Acetic acid cannot be made from calcium acetate to sell at present prices except by charging in the acetate at a ruinously low price.

A plant for the direct recovery of the acetic produced in one of the average-sized units—60 cords daily capacity—is shortly to go into operation in the Pennsylvania district utilizing a process developed and already successfully used on a very large scale in this country for concentrating dilute acetic acid. Other plants with a daily capacity below 50 cords are considering its immediate adoption, and because of its simplicity and economy of operation, any unit down to 20 or less cords a day will find its use practical, and economical; and a tremendous saving over any possible sale of calcium acetate for a pooled conversion project, with its basic chemical and mechanical wastes.

Even the present prices for charcoal, methanol, (and tar oils when sold) indicate that the marginal product, the acetic-acid radical, has a production cost so low that when added to the low cost of operation of the above process, the final product—refined, glacial acetic acid—can be manufactured at a cost, considerably below that of acid from either of the synthetic processes. On the other hand, the basic lack of economy in the lime-sulphuric method precludes successful competition on any scale, even considering the advantages of pooling.

The danger to the wood-chemical industry is more fundamental than rugged individualism, it is technical obsolescence; not to be overcome by making a common grave of the bones of former successes.

The paradox of the situation is that wood distillers may "die on the bases" with their lime acetate, while the other team, more modern in chemical engineering processes "goes to bat" with a fundamentally more expensive product.

Donald F. Othmer,
Assistant Professor of Chemical Engineering, Polytechnic Institute,
Brooklyn, N. Y.

Correction

Our attention has been called to the unfortunate omission of the American Platinum Works, Newark, N. J. from the *Chem. & Met.* Directory of Materials of Construction published last month. This company has been a refiner of silver for use in chemical engineering equipment since 1930.

Chemical Engineer's BOOKSHELF

Critics of the New Deal

BEYOND THE NEW DEAL. By *David Lawrence*. Published by Whittlesey House, New York. 321 pages. Price, $2.50.

AMERICA'S HOUR OF DECISION. By *Glenn Frank*. Published by Whittlesey House. New York. 263 pages. Price, $2.50.

Reviewed by *S. D. Kirkpatrick*.

TWO EXCEPTIONALLY able writers take up the cudgels of criticism against some of the confusing mass of policies and politics that have come to be associated in our minds with the New Deal. These books complement and supplement each other. Lawrence, the liberal conservative, is the factual searcher whose piercing analyses are those of the trained observer and careful student of government. Despite the implications of its title, and its frankly questioning attitude, the book as a whole is not unfriendly and is constructive rather than destructive in its criticism.

Dr. Frank we may call the conservative liberal, although we are told that some would prefer to think of him as a reformed radical. His book is a most interesting philosophy of social reform, written in almost lyrical style, as a stimulating challenge of many of the concepts of the New Deal. His chapter "Science Betrayed" is in itself a real contribution from the viewpoint of the technologist. It states the scientist's *raison d'etre* and pleads his case with the public far better than he could hope to do it himself. The titles of other chapters such as "Democracy Flouted," "Freedom Invaded," "Plenty Renounced," "Education Hamstrung," "Religion Exiled," "Nationalism Amuck" are indicative of the vigorous tempo of this criticism. Whether one agrees or not with the author's politics, his policies are certain to become the basis of considerable discussion between now and November, 1936.

CODES, CARTELS, NATIONAL PLANNING. By *Bruno Burn*. McGraw-Hill Book Co., New York. 413 pages. Price, $4.

AMONG THE GOOD which has been derived from the present industrial and economic depression must be listed the desire, or rather the determination, to find means whereby future recurrences may be minimized or preferably prevented. That this can only be attained through a better planning and regulation of our industrial life is also generally accepted. The controversy which has grown so hot during the past year is mainly concerned with the means adopted by the present administration to accomplish these purposes. Whatever one's personal opinion may be, all should welcome any effort to throw light upon this difficult subject. The author, who has extensive experience in this field, at home and abroad, presents a comprehensive analysis of the situation and makes many constructive suggestions how to overcome some of the difficulties involved. Numerous charts, descriptions of methods employed in regulating production and marketing, and discussion of various cartel agreements furnish material which should be of value in the creation of a machine for industrial self-government.

Electrokinetics

ELECTROKINETIC PHENOMENA AND THEIR APPLICATION TO BIOLOGY AND MEDICINE. By *Harold A. Abramson*. Chemical Catalog Co., New York. 331 pages. Price, $7.50.

Reviewed by *S. S. Kistler*.

ALTHOUGH Abramson has had in mind primarily the needs of the biochemist in the preparation of this book, he has done a favor to chemistry in general by assembling in readable form the topics now included under chemical electrokinetics.

The book opens with an historical introduction followed by two chapters (II and IV) in which the development of theory is systematically presented. Here the emphasis seems continually to have been placed upon clarity of expression rather than exhaustiveness, which has resulted in a treatise particularly well suited to the needs of those who have limited time but desire an authoritative introduction to the underlying principles.

Chapter III goes into detail on the methods of measurement of electrophoresis, electroosmosis, streaming and sedimentation potentials.

Chapters V to IX cover studies with specific surfaces, while X and XI are primarily directed to biological problems.

Although electrokinetic processes have not as yet been widely applied to industrial problems, it is safe to predict their greater use in the future. Many industrial chemists and engineers will find it unwise to overlook such information as is contained in this book, no small part of which is the list in the appendix of approximately five hundred patents covering such practical problems as leather tanning, the electrodeposition of latex, and the purification of water, clay, serum, etc.

The paper and printing are very good. Unfortunately there has been carelessness in the preparation of some of the figures.

Fuel Standards

A.S.T.M. STANDARDS ON COAL AND COKE. Prepared by Committee D-5 on Coal and Coke. Published by American Society for Testing Materials, 260 South Broad St., Philadelphia. 108 pages; paper. Price, $1.

THIS IS THE FIRST TIME that a few compilations of standard and tentative specifications and tests of coal and coke have been published together. The booklet includes five specifications, 13 methods of test, and the standard definitions of terms relating to coal and coke as fixed by A.S.T.M.

CHEMISCH - TECHNISCHE ENTWICKLUNG AUF DEM GEBIETE DER KOHLENWASSERSTOFFÖLE. Vol. II, 1928-1932. Edited by M. Pflücke with assistance of Carl Walther. Verlag Chemie G.m.b.H., Berlin. 695 pages. Price, 60 Rm.

Reviewed by *B. H. Strom*.

IN VIEW of all the present efforts to make Germany independent of imported motor fuels much significance must be attached to this volume on the technical progress made in the field of liquid hydrocarbons during the period 1928-32. The book has been edited by the staff of *Chemische Zentralblatt* under the direction of the editor-in-chief, Dr. Maximilian Pflücke, with assistance of Carl Walther, a well-known petroleum engineer, and his associates. It contains data presented in German and foreign patent literature for the period given, arranged in a clear and comprehensive manner, generally in the abstract form used by *Zentralblatt*. In addition to reviews of pure research work one may also find the entire international patent literature on cracking and hydrogenation, distillation, refining, paraffine removal, production of lubricating oils, preliminary treatment of oil prior to distillation,

oxidation, treatment of shale and tar oils, and analysis. Short reviews giving the main trends precede all main chapters; these reviews also contain 38 illustrations bringing out the characteristic features of the processes.

The forerunner to this work is the book issued in 1928, "Leichte Kohlenwasserstofföle" (Light Liquid Hydrocarbons), by M. Naphtali, who has also assisted in the preparation of the new volume. The two volumes, with over 1,200 pages and more than 200 illustrations, present a comprehensive review of the immense work done in this field during the last 15 years, and they also serve as a foundation for all future work in hydrocarbon research.

BOILING POINT CHARTS. Prepared and for sale by *F. E. E. Germann and Odon S. Knight*, Department of Chemistry, University of Colorado, Boulder, Colo. Two charts, 30 x 12 in. Price, $2.

VAPOR pressures in the range from 500 to 900 mm. of mercury, and their corresponding temperatures, are given for some 190 organic compounds (and water) in two line coordinate charts which have been prepared by the authors. For each compound a straightedge pivoted about a certain marked point intersects the two scales of vapor pressure and corresponding temperature at all values for that particular compound, within the range of the chart. The charts are said to involve no approximations and to make possible the reading of all vapor pressures with a high degree of precision. Accuracy, for the most part, is stated to be equal to that of the data used in the preparation of the charts.

DIE EDELSTAHLE. Second Edition. By *F. Rapatz*. Julius Springer, Berlin. 386 pages. Price, 22.80 Rm.

MUCH PROGRESS has been made in the field of alloy steels during the ten years which have elapsed since the first edition of this book appeared. Among the changes made in the new edition is the large additional space given to new uses and applications. Although primarily intended for the practicing metallurgist, the book should also be useful as a reference work for the user of these steels.

TWENTY QUESTIONS ON THE ECONOMIC SECURITY OF THE PEOPLE. A study outline prepared by the Industrial Department of the National Council of Young Men's Christian Associations in cooperation with a group of industrial, insurance, and labor leaders. Published by Association Press, New York. 48 pages. Price, 25c.

PROVISION of sound economic security is unquestionably one of the great national issues, a subject that should concern every thinking man and woman. This outline, based on 20 questions, has been prepared to throw light on all the complicated problems involved. A study of these questions and the material furnished to give the true answers should enable any person to make an intelligent analysis of the situation. The better the cooperation thus afforded those entrusted with the task of working out this problem, the firmer the foundation of economic security of each individual citizen.

AIR CONDITIONING DATA. Bulletin 27. Published by Kansas City Testing Laboratory. 12 pages. Price, $0.25.

THIS little pamphlet summarizes in compact form the principal tabular matter of interest to users of air conditioning equipment. Of particular note are a table on the properties of saturated air from zero to 212 deg. F. and an easy-to-use psychrometric chart for determining relative humidities.

GOVERNMENT PUBLICATIONS

Documents are available at prices indicated from Superintendent of Documents, Government Printing Office, Washington, D. C. Send cash or money order; stamps and personal checks not accepted. When no price is indicated pamphlet is free and should be ordered from bureau responsible for its issue.

The Tariff, a Bibliography. U. S. Tariff Commission miscellaneous unnumbered document, 980 pages, paper covered; $1.00.

Regulation of Tariffs in Foreign Countries by Administrative Action, With Appendix. U. S. Tariff Commission, Miscellaneous Series, Revised to July 1, 1934; 5 cents.

The Balance of International Payments of the United States in 1933, by Amos E. Taylor. Bureau of Foreign and Domestic Commerce, Trade Information Bulletin 819; 10 cents.

Quicksilver Deposits of Southwestern Oregon, by Francis G. Wells and Aaron C. Waters. Geological Survey Bulletin 850; 30 cents.

Doctoral Dissertations Printed in 1932. List of American theses received in the catalog division of the Library of Congress from January, 1932, to October, 1933, with supplement to earlier lists, compiled by Mary Wilson McNair; 50 cents.

Exhaust Gases and Other Products of Combustion in Airplane Engines and Their Effect on Man, by Major Malcolm C. Grow. Air Corps Information Circular No. 694.

Safety Standards for the Protection of the Head, Eyes, and Respiratory Organs. U. S. Navy Yards and Naval Stations, unnumbered document; 10 cents.

Efficiency of Carboxide Gas as Insecticidal Fumigant for Naval and Merchant Vessels, by E. W. Brown. From United States Naval Medical Bulletin, v. 32, No. 3.

The Comparative Effectiveness, in the Dairy Ration, of Supplements of Phosphorus in the Form of Orthophosphoric Acid, Monosodium, Disodium, Trisodium Phosphates, and Bone Meal, by William A. Turner and others. Reprint from Journal of Agricultural Research, Vol. 48, No. 7, April 1, 1934; 5 cents.

Flax-Fiber Production, by B. B. Robinson. Department of Agriculture, Farmers' Bulletin 1728; 5 cents.

Solid Carbon Dioxide. Bureau of Standards, Letter Circular LC-420, Revised to July 9, 1934; mimeographed.

Thermal Insulation. Bureau of Standards Letter Circular LC-421; mimeographed.

Preservation of Newspaper Records, by B. W. Scribner. Bureau of Standards Miscellaneous Publication 145; 5cents.

Regulations Relating to the Producers' Tax on Crude Petroleum, Tax on Refining of Crude Petroleum, and Tax on Gasoline Produced or Recovered From Natural Gas Under the Revenue Act of 1934. Bureau of Internal Revenue Regulations 49; 5 cents.

Wholesale Druggists' Operations. Bureau of Foreign and Domestic Commerce, Domestic Commerce Series 86; 15 cents.

U. S. Import and Exports Trade. A set of forty large charts giving graphically the data which are commonly available in current statistical reports. Copies of the complete set of charts are available for $4.00 from the Division of Foreign Trade Statistics, Bureau of Foreign and Domestic Commerce.

Occupational-Disease Legislation in the United States. From the Monthly Labor Review of June, 1934.

Production Statistics From 1933 Census of Manufactures in preliminary mimeographed form for: Steel-works and rolling-mill products; sand-lime brick; clay products (other than pottery) and nonclay refractories; wood preserving; pyroxylin plastic; pulp goods and molded composition products; hydrogen peroxide; salt cake; rubber tires and inner tubes; explosives; pottery; coke-oven products; printing ink; sodium compounds; rayon and allied products; oleomargarine and other margarines.

The Use of Treated Mine Ties and Timbers in Illinois and Indiana Coal Mines, by C. A. Herbert. Bureau of Mines Information Circular 6797; mimeographed.

Summary of Mineral Production. Statistical Appendix to Bureau of Mines Minerals Yearbook 1932-33; 5 cents.

Self-Contained Oxygen Breathing Apparatus. Bureau of Mines, Handbook for Miners; 40 cents.

Minerals Yearbook, 1934. Bureau of Mines unnumbered book, 1154 pages; $1.75. Scheduled to be off the press the latter part of October, 1934.

Mineral Production Statistics for 1933—preliminary mimeographed statements from Bureau of Mines on: Secondary metals; masonry, natural, and puzzolan cement; nickel; lime; copper; lead and zinc pigments and zinc salts; portland cement; crude petroleum and petroleum products.

Coke and Byproducts Tables, 1933, by W. H. Young and H. L. Bennit. Bureau of Mines unnumbered document; mimeographed.

Active List of Permissible Explosives and Blasting Devices Approved Prior to June 30, 1934, by J. E. Tiffany. Bureau of Mines Report of Investigations 3259; mimeographed.

Mineral Production of the United States. A small map showing by states the value of mineral products in recent years divided into four classes—metallic, non-metallic, coal, other fuels.

Production Statistics From 1931 Census of Manufactures—printed pamphlets on chemicals, compressed and liquefied gases, and approximately 50 other supplements scheduled for printing two years ago, but delayed through economy, are now available. The bound volume from the 1931 Census will also be ready for sale, price not yet determined, late in the Fall. Subsequent announcement will be made when it is available.

Paper and Paperboard Production, Paper-Making Equipment in Use, Pulpwood Consumption, and Wood-Pulp Production, 1932. Bureau of the Census; 5 cents.

Federal Specifications. New or revised specifications of the Federal Specifications Board on: Barrels, steel, type 5; oil, lard; oil, cutting, soluble; detergent, hand, paste, and powder (for) mechanics' use; magnesia, block, cement, and pipe-covering (molded); varnish, asphalt; varnish, mixing, for aluminum-paint; white-lead, basic-carbonate, dry, paste-in-oil, and semipaste-in-oil; white-lead, basic-sulphate, dry and paste-in-oil; wood-preservative, coal-tar creosote for ties and structural timbers; wood-preservative, creosote-coal-tar-solution for ties and structural timbers; wood-preservatives, zinc-chloride for ties and structural timbers; zinc-oxide, dry and paste-in-oil.

Your Plant NOTEBOOK

NON-MECHANICAL DEVICES FOR PRESSURE RELIEF

By G. E. Seavoy
Chemical Engineer
Swenson Evaporator Co.
New York, N. Y.

HYDROSTATIC pressure relief devices are of use in a number of more or less special cases in chemical plant work. As they have no moving parts which may be made inactive by corrosion or other causes, they cannot fail to operate at a crucial moment. Two of these devices are shown in Figs. 1 and 2.

In Fig. 1 is a relief applied to a pumping system in which the hydrostatic pressure is maintained by the same fluid that is being pumped. The vertical standpipe from the pump has a cross-over, vent and overflow back to the feed tank. The height of the point O can be made such that the static pressure of the fluid column will equal the relief pressure desired at point C. The relationship is:

$$H = \frac{2.31\ P}{\text{Sp. gr. of fluid pumped}}$$

where H is the vertical height in feet and P the desired relief pressure at C in pounds per square inch gage. This scheme is obviously applicable only to relatively low pressures.

A mercury hydrostatic system for use with a pressure vessel is illustrated in Fig. 2. It is designed to give an alarm should the pressure go too high and, eventually, to vent the tank if the alarm is disregarded. The sealed chamber V contains a relatively large quantity of mercury compared to the volume of mercury in the vertical riser R, so that a change in the level in V will be small for any change in level of R. This is desirable in order that the alarm may be able to operate several times before vessel V needs to be refilled.

In case the tank pressure should rise as high as the initial alarm pressure, corresponding to the height H, overflow of mercury into tank O will lift a float or complete an electrical circuit and sound the alarm. The relation between the height of the mercury column and the pressure is:

$$H = \frac{2.31\ P}{13.6} = 0.17\ P$$

where H and P are defined as above. Should the alarm be disregarded and the pressure continue to rise, more mercury will be forced over into O and the mercury level in V will continue to fall until eventually the bottom of the relief pipe R will be exposed and the tank will be vented to the atmosphere.

Thus the height of V can be chosen so as to give any desired spread between the pressure at which an alarm is first given and the pressure at which relief will occur. Similarly, the relation between the volumes of V and R can be chosen to give sufficient time for the operator to reduce the pressure before relief occurs.

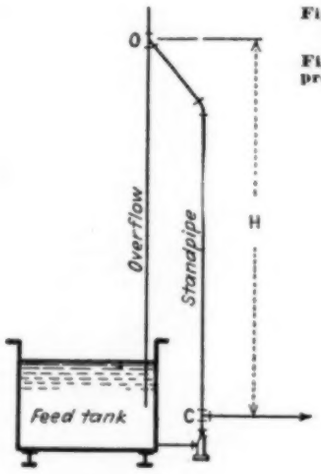


Fig. 1 — Hydrostatic relief for pump, using fluid pumped

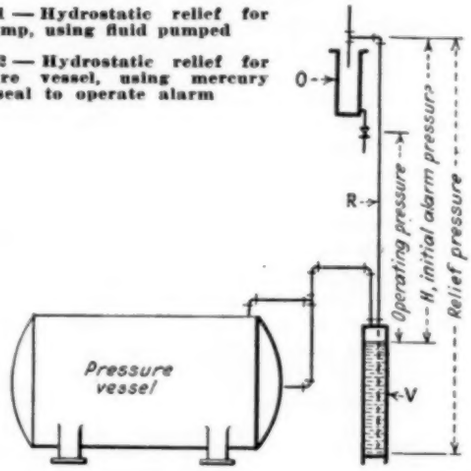


Fig. 2 — Hydrostatic relief for pressure vessel, using mercury seal to operate alarm

NOMOGRAPH FOR CONTENTS OF HORIZONTAL TANKS WITH BULGED ENDS

By D. S. Davis
Dale S. Davis' Associates
Watertown, Mass.

CALCULATION of the contents of a partially filled horizontal tank is a bit troublesome, particularly when the tank has bulged ends, which is generally the case. Resort is usually made to a set of two tables, one of which covers the main or cylindrical portion and the other the spherical ends. Tables for the cylindrical portion are to be found in Perry's "Chemical Engineers' Handbook," p. 115, McGraw-Hill Book Co., 1934, while tables for both parts are available in Sullivan's "Sulphuric Acid Handbook," pp. 150-4, McGraw-Hill Book Co., 1918. The tables leave something to be desired in the matter of ease of interpolation and in the fact that some of them cover only the bottom half of the tank, requiring additional calculations for tanks more than half-filled.

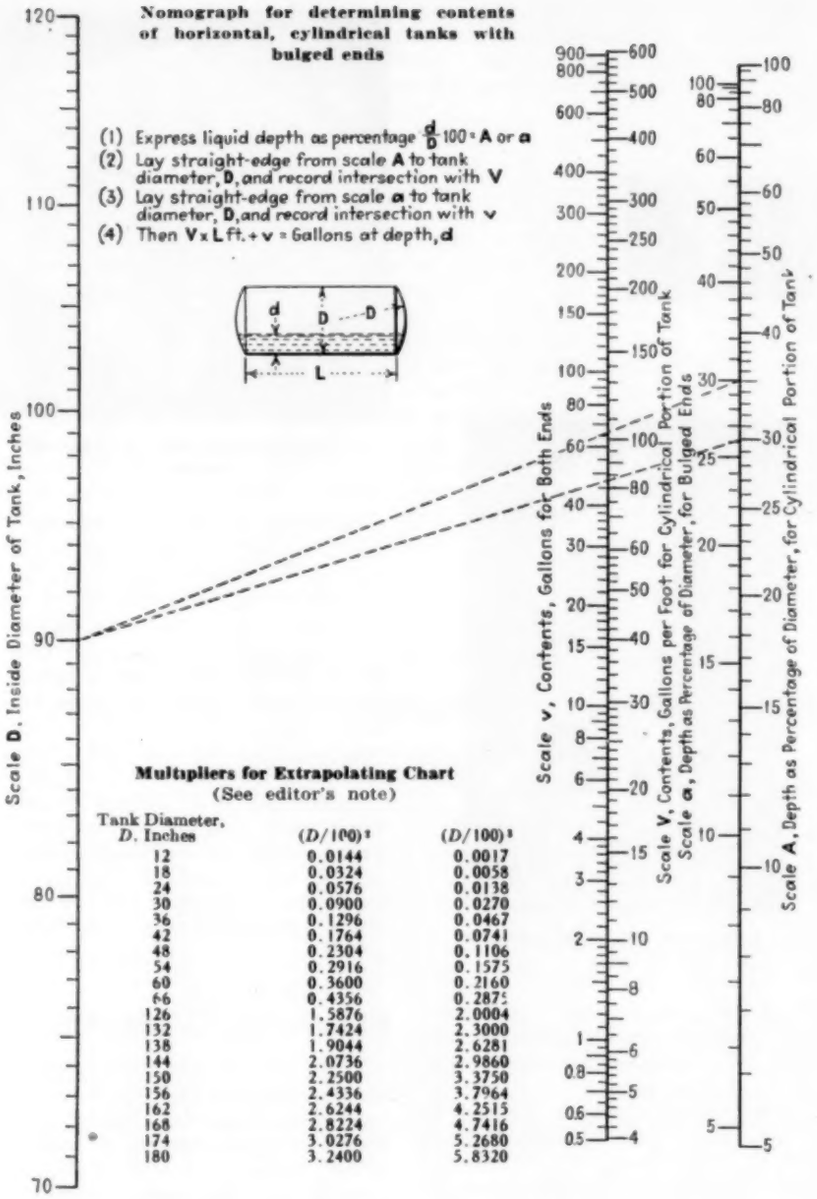
The accompanying alignment chart, which presents similar data in a more convenient form than do the tables, is based upon the following relationships:

$$V = 0.0408\ D^2\ f \qquad (1)$$

where, for the cylindrical portion,
V = contents, gallons per foot of length
D = inner diameter, inches
f = depth factor

and $$v = 0.00866\ D^3\ g \qquad (2)$$

where, for the bulged ends which are portions of a sphere the radius of which


Nomograph for determining contents of horizontal, cylindrical tanks with bulged ends
(1) Express liquid depth as percentage $\frac{d}{D} \times 100 = A$ or a
(2) Lay straight-edge from scale A to tank diameter, D, and record intersection with V
(3) Lay straight-edge from scale a to tank diameter, D, and record intersection with v
(4) Then V x L ft. + v = Gallons at depth, d
d
D
D
L
Scale D, Inside Diameter of Tank, Inches
Scale v, Contents, Gallons for Both Ends
Scale V, Contents, Gallons per Foot for Cylindrical Portion of Tank
Scale a, Depth as Percentage of Diameter, for Bulged Ends
Scale A, Depth as Percentage of Diameter, for Cylindrical Portion of Tank

Multipliers for Extrapolating Chart
(See editor's note)

Tank Diameter, D, Inches	$(D/100)^2$	$(D/100)^3$
12	0.0144	0.0017
18	0.0324	0.0058
24	0.0576	0.0138
30	0.0900	0.0270
36	0.1296	0.0467
42	0.1764	0.0741
48	0.2304	0.1106
54	0.2916	0.1575
60	0.3600	0.2160
66	0.4356	0.2875
126	1.5876	2.0004
132	1.7424	2.3000
138	1.9044	2.6281
144	2.0736	2.9860
150	2.2500	3.3750
156	2.4336	3.7964
162	2.6244	4.2515
168	2.8224	4.7416
174	3.0276	5.2680
180	3.2400	5.8320

is equal to the diameter of the tank,
v = contents of both ends, gallons
g = depth factor.

On the chart, the depth factors, f and g, are replaced, for convenience, by two scales of depth, A and a, which express depth as a percentage of the diameter.

The broken lines illustrate the use of the chart. A cylindrical tank with bulged ends, resting upon its side, is 20 ft. in length, exclusive of the ends, has an inner diameter of 90 in. and is filled to a depth of 27 in. What is the liquid content? A depth of 27 in. represents 30 per cent of the diameter. Connect 30 on the A scale with 90 on the D scale and read the contents of the cylindrical portion on the V scale as 83.4 gal. per ft. Multiplication by 20 gives 1,668 gal. Connect 30 on the a scale with 90 on the D scale and read the sum of the contents of the two bulged ends (on the v scale) as 66 gal. The total liquid volume is, then, 1,668 + 66 or 1,734 gal.

The converse problem may be solved by a trial-and-error method as follows: It is desired to pump 900 gal. into a horizontal tank with bulged ends, the diameter of the tank being 80 in. and the length, 16 ft. What will the depth be? The quotient of 900 and 16 is 56.3 gal. per ft. Because of the bulged ends the actual value will be a little less than this, say, 54 gal. per foot. Using the chart connect 80 on the D scale with 54 on the V scale and read the percentage depth on the A scale as 26. Connect 26 on the a scale with 80 on the D scale and read the contents of the bulged ends as 33 gal. The product of 54 and 16 or 864 gives the number of gallons in the main tank. This increased by 33 gives 897, which is sufficiently close to the true total, 900. The liquid depth is $0.26 \times 80 = 20.8$ in.

(*Editor's Note*—In the absence of tables the chart may readily be used for larger or smaller tanks through a little simple slide-rule calculation. Per foot of length the volumes of two cylinders are as the squares of their diameters, while the volumes of their bulged ends are as the cubes of their diameters. Therefore, a tank of, say. 48 in. diameter may be calibrated by determining the volumes at each percentage depth of a tank of, say, 100 in. diameter and multiplying each by $(48/100)^2$ for the cylindrical portion; and by $(48/100)^3$ for the bulged ends. The results are the volumes for the 48-in. tank for the corresponding percentages of depth. The table on the face of the chart gives the values of these multipliers for several tank diameters.)

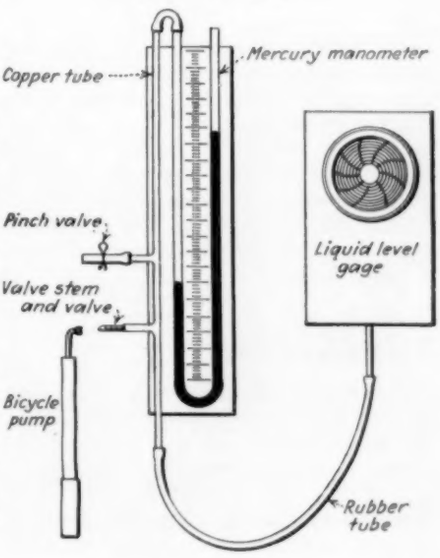
Manometer for Calibrating A Level Gage

By J. M. Wilcox
Longview Fibre Co.
Longview, Wash.

AN ORDINARY water column is rather unwieldy to use with liquid level gages that read to more than 10 ft. head of water, and a dead-weight tester does not have small enough divisions of weights. A manometer filled with mercury is a simple and easily built device for calibrating gages between the ranges of 5 and 50 ft. of head.

The manometer is connected to the gage with a length of rubber tubing and a small bicycle pump is used to supply any pressure required. For convenience, the scale on the manometer may be read directly in feet of water. An outlet with a pinch valve is supplied to relieve the pressure.

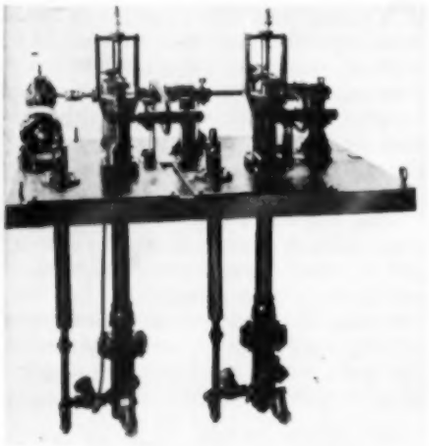
Hookup of manometer and liquid level gage



News of EQUIPMENT

Sulphur Pump

For the trouble-free handling of molten sulphur the Hills-McCanna Co., 2349 Nelson St., Chicago, Ill., has introduced a new pump which is supplied in duplicate, as in the accompanying illustration. The two units are mounted on a single base, thus providing one for operation and one as a spare. A single drive, operating through a clutch, makes it possible to change immediately from one pump to the other if necessary.

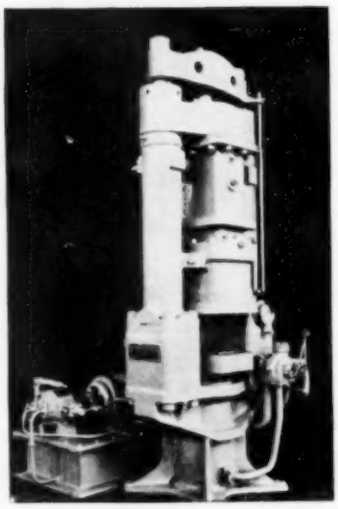


Double unit pump for sulphur

In order to prevent side play the pumps employ the guided plunger principle, as the pumping mechanism is at the bottom of the pit. Each unit can be entirely removed from the pit without interfering with the other. It is only necessary to loosen four bolts to lift out the entire unit. The discharge pipe, it will be noted, is provided with a steam jacket.

Solid CO_2 Press

For the manufacture of solid carbon dioxide the Baldwin-Southwark Corp., Philadelphia, Pa., has put on the market an improved press for the compacting of the CO_2 "snow" into the solid blocks of commerce. The new press is entirely self-contained, being supplied with a two-pressure hydraulic power supply built as a unit which is attached to the press or mounted at some convenient nearby point.

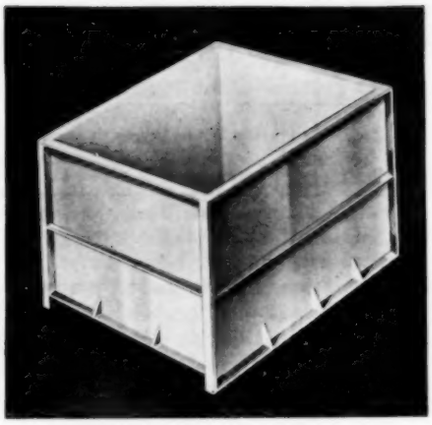


New press for solid carbon dioxide

Among the advantages claimed for the new press may be mentioned the following: As there is no hydraulic cylinder above the "snow" chamber, there is no chance for oil to enter the chamber and discolor the product. The machine is of extremely rigid construction, requires only low head room, and has only three stuffing boxes, and these outside packed.

Stainless Tank

In order to make possible a low cost construction for tanks of expensive metals the Rodney Hunt Machine Co., Orange, Mass., has developed the new "Thincon" type of construction in which, during fabrication, the thin sheets making up the walls and bottom of the tank are bowed to the shape they would tend to take under load. By this means thin-gage material, such as solid stainless steel, may be employed without fear, it is stated, that alternate fillings and emptyings will cause breakage through repeated flexure. This construction has also made it possible to avoid heavy reinforcing, with the result that sufficient strength can be developed in exceedingly light construction.



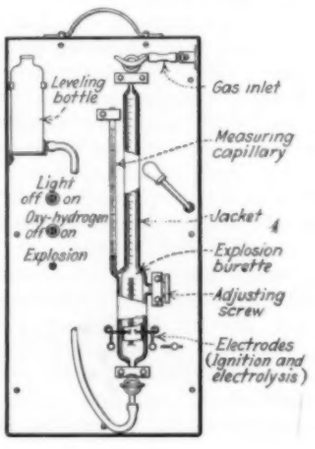
Stainless steel tank of "Thincon" construction

The accompanying illustration, while too small to show the bulge that is put into the walls in fabrication, demonstrates the light and simple nature of the reinforcement. Fabrication is as follows: Sides and bottom are first welded together, after the top and bottom of each piece have been bent out to form a ledge. Then, to prevent flexure on filling, each wall in turn is bent into convex shape and welded to a reinforcing rib which holds it in shape. As generally employed, the reinforcing ribs are hollow; hence, both light and strong.

Portable Gas Calorimeter

High accuracy in determining the heating value of gases, without the requirement of special training or cumbersome preparations and difficult calculations, is said to be possible with a new portable gas calorimeter recently announced by the Hays Corp., Michigan City, Ind. Tests require about one to two minutes, on the average, and consume from 5 to 25 c.c. of gas. The

New portable gas calorimeter



measured gas sample is mixed with air and exploded in a calibrated burette. The heat produced by the mild explosion is absorbed by surrounding liquid which expands, giving a reading in a calibrated capillary tube. The result is then compared with a test gas, oxy-hydrogen, which is generated in the instrument by the electrolytic decomposition of water. Since the two gas samples are tested under similar conditions, no corrections of any kind are necessary and the result is obtained by the aid of a few very simple calculations.

The accompanying outline drawing shows the principal parts of the calorimeter. The two electrodes near the bottom of the burette chamber, it should be noted, are used both to bring about the explosion and to electrolyze the water to produce the comparison gas. In addition to its use for determining the heating value of gases, the calorimeter may be used to ascertain the amount of combustibles unburned in whole gases and for testing the explosive properties of gases.

Correction: In an article on page 490 of our September, 1934, issue, describing the Multizone washer for gases developed by the Freyn Engineering Co., Chicago, Ill., it was stated that "The result of the last cleaning stage is to remove 80 to 90 per cent of the dust remaining in the exit gas." This statement is not clear and should have read "The third zone of the washer removes 85 to 90 per cent of the dust remaining after the first two stages." Since the first two stages are said to remove a great deal of dust, the performance for the three stages is high, for example, resulting in the removal of over 98 per cent of the dust from a typical blast furnace gas.

MANUFACTURERS' LATEST PUBLICATIONS

Abrasives. The Norton Co., Worcester, Mass.—26 pages, illustrated, describing the history and development of abrasives.

Bearings. Bantam Ball Bearing Co., South Bend, Ind.—32 pages on straight-roller radial and thrust bearings.

Chemicals. Carbide & Carbon Chemicals Corp., 30 East 42d St., New York City—77-page summary of synthetic organic chemical products of this company, with data, specifications and descriptions of all products.

Chemicals. Monsanto Chemical Co., St. Louis, Mo.—"How Monsanto Serves," 24-page booklet, describing history and activities of this company, together with pictorial presentation of the way in which this company's chemicals enter into products of everyday use.

Chemicals. The Neville Co., Pittsburgh, Pa.—7 pages on the properties of this company's benzol and its use as a blending material for motor fuels.

Chemicals. Southern Alkali Corp., Corpus Christi, Tex.—16-page book describing the location, markets and products of this company.

Construction Materials. Structural Gypsum Corp., 30 Rockefeller Plaza, New York City—Bulletin 34-C—28 pages on steel-reinforced gypsum planking for construction purposes, made by this company.

Dark Room. Bausch & Lomb Optical Co., Rochester, N. Y.—Poster giving layouts and complete details with estimated costs, etc., of two photomicrographic dark rooms.

Electrical Equipment. Crocker-Wheeler Electric Mfg. Co., Ampere, N. J.—16-page booklet, describing the use of synchronous motors for driving equipment not requiring variable or adjustable speed.

Electrical Equipment. General Electric Co., Schenectady, N. Y.—Publications as follows: GEA-1137B, 8 pages on indoor cubicle switchgear; GEA-1327A, 4 pages on indoor disconnecting switches; GEA-1585A, high voltage magnetic switches; GEA-1838, 128-page catalog on industrial cable; GEA-1924, 12 pages on controlled-atmosphere electric furnaces and their auxiliaries.

Electrical Equipment. Roller-Smith Co., 233 Broadway, New York City—Catalog 5—14 pages on a new line of air circuit breakers for heavy duty.

Electrical Equipment. Weston Electrical Instrument Corp., Newark, N. J.—12-page bulletin describing a wide range of relay types manufactured by this company.

Engines. Worthington Pump & Machinery Corp., Harrison, N. J.—Bulletin S-550-B6—6 pages describing vertical four-cycle gas engines.

Equipment. First Machinery Corp., 419 Lafayette St., New York City—Leaflet illustrating equipment for drugs, cosmetics and pharmaceuticals, including filters, mixers, fillers, labeling machinery, and so on, available from this company.

Equipment. Harnischfeger Corp., Milwaukee, Wis.—"The 50th Year," 84-page anniversary booklet, describing history, past and present products of this company.

Equipment. Roots-Connersville Blower Corp., Connersville, Ind.—Bulletins 22; 23-B10—6 pages on standard and heavy duty blowers of the cycloidal type, manufactured by this company; also Bulletin 100-B12, 4 pages on the Harrison inert gas producer for purging pipe lines and equipment.

Equipment. Semet-Solvay Engineering Corp., 40 Rector St., New York City—Folder describing engineering services offered to the gas industry by this company.

Equipment. Struthers-Wells Co., Warren, Pa.—Bulletin M-13—10 pages describing this company's fabrication of machine parts by welding.

Equipment. U. S. Stoneware Co., 50 Church St., New York City—Leaflet describing stoneware Hills-McCanna valves and stoneware cooling and condensing coils.

Equipment. Yarnall-Waring Co., Chestnut Hill, Philadelphia, Pa.—Bulletin WG-1803—16 pages on water columns and gages for boilers.

Filtration. Filtration Engineers, Inc., Summer Ave. and Erie R.R., Newark, N. J.—New bulletin descriptive of continuous vacuum filters for chemical processes.

Filtration. Filtration Equipment Corp., 350 Madison Ave., New York City—8 pages on vacuum filters and Laughlin bar screens and automatic sand filters made by this company.

Fumigation. R. & H. Chemicals Department, E. I. duPont de Nemours & Co., Inc., Wilmington, Del.—Group of ten leaflets and booklets on the use of hydrocyanic acid gas in fumigation.

Furnaces. Detroit Electric Furnace Co., 825 West Elizabeth St., Detroit, Mich.—Leaflet describing a new small multi-purpose rocking electric furnace for metal melting.

Furnaces. Hevi Duty Electric Co., Milwaukee, Wis.—Bulletin HD-934—Folder describing box-type, air-draw furnaces.

Furnaces. W. S. Rockwell Co., 50 Church St., New York City—Bulletin 349—Leaflet describing continuous controlled-atmosphere furnaces.

Heating Unit. Harold E. Trent Co., 618 North 54th St., Philadelphia, Pa.—Leaflet describing electric immersion heaters for oil heating.

Instruments. Cambridge Instrument Co., Ltd., 45 Grosvenor Place, London, S.W.1, Eng.—6 pages on pH meters and continuous recorders for laboratory and industrial use.

Instruments. The Esterline-Angus Co., Indianapolis, Ind.—Bulletin 834—8 pages on pressure-recording instruments, including pressure relays and telemeters.

Instruments. The Foxboro Co., Foxboro, Mass.—Folders describing features of Foxboro recorders; and an improved meter for temperature, pressure and flow.

Instruments. H-B Instrument Co., 2518 North Broad St., Philadelphia, Pa.—Blue Book, Part II—16 pages on a wide range of hydrometers and thermo-hydrometers, manufactured by this company.

Instruments. Leeds & Northrup Co., 4901 Stenton Ave., Philadelphia, Pa.—Bulletin 53-116—12 pages on equipment for temperature-limit control for furnace roofs.

Lacquers. Sharples Solvents Corp., 23d and Westmoreland Sts., Philadelphia, Pa.—24 pages on this company's process for the production of lacquers that will level without sanding.

Metals and Alloys. Crucible Steel Co. of America, 405 Lexington Ave., New York City—General Catalog Section 3—80 pages with properties and uses on corrosion and heat-resisting steels made by this company.

Metals and Alloys. Michiana Products Co., Alloy Division, Michigan City, Ind.—New bulletin on corrosion and heat-resisting alloy castings.

Packing. Chicago Belting Co., 113 North Green St., Chicago, Ill.—4 pages of information on hydraulic packings.

Piping. Hays Mfg. Co., Erie, Pa.—Catalog Section 3—24 pages describing this company's "double-seals" for copper tubing, including valves and fittings adapted to this jointing method.

Power Transmission. The Falk Corp., Milwaukee, Wis.—Bulletin 272—35 pages with description and engineering data on motorized speed reducers.

Pumps. Beach-Russ Co., 50 Church St., New York City—Bulletin 60—4 pages describing several models of rotary pump for liquids, semi-liquids and pastes.

Pumps. Viking Pump Co. of Delaware, Cedar Falls, Ia.—Bulletin A-700-34—Leaflet describing the Viking-Monarch combination valve strainer and fuel-oil pump.

Pumps. Worthington Pump & Machinery Corp., Harrison, N. J.—W-423-B2—4 pages on automatic power pump receiver sets; W-318-B5, 4 pages on two-stage volute centrifugal pumps; WP-1034, 12 pages describing this company's service at A Century of Progress Exposition and earlier World's Fairs.

Refractories. McLeod & Henry Co., Troy, N. Y.—1935 catalog on the design, installation and service advantages of this company's furnace linings and arches for boiler furnaces.

Refrigeration. Carbondale Machine Co., Carbondale, Pa.—Bulletin 234—8 pages on this company's new Carbondale Alternator air-agitating system for ice making.

Refrigeration. Elliott Co., Jeannette, Pa.—Bulletin G-5—14 pages on steam-jet vacuum cooling equipment made by this company.

Regulators. Smoot Engineering Corp., 2240 Diversey Parkway, Chicago, Ill.—Catalog S-10—24 pages describing principles of regulators made by this company, together with applications.

Services. E. Y. Sayer Engineering Corp., 152 West 42d St., New York City—Bulletin 17—24 pages describing this company's engineering services in design, consultation and complete engineering projects.

Solutions. Pfaltz & Bauer, Inc., 300 Pearl St., New York City—Leaflet describing use of Fixanal preparations for making volumetric solutions.

Tubing. Summerill Tubing Co., Bridgeport, Montgomery Co., Pa.—Leaflet describing the manufacturing processes used by this company in making drawn tubing; also leaflet describing a few of the tubing specialties made by this company.

Water Treatment. Cochrane Corp., 17th St., Philadelphia, Pa.—Bulletin 700—24 pages on deaerating heaters made by this company; Bulletin 689, 48 pages on fundamentals of and recent developments in the conditioning of boiler feedwater by the hot and cold processes and zeolite softeners.

Welding. Air Reduction Sales Co., Lincoln Bldg., New York City—8 pages on this company's line of Airco-Wilson arc welders; 16-page booklet on oxyacetylene welding and cutting pressure regulators and regulation problems.

Welding. Lincoln Electric Co., Cleveland, Ohio—Welder Specification Bulletins 303, 304, and 305—Give specifications on three belt-driven and two engine-driven welders.

Chemical Engineering NEWS

Refrigerating Machinery Association Meets

THE Refrigerating Machinery Association held its Twenty-First Annual Meeting at the Stevens Hotel, Chicago on Oct. 22 and 23. Because of the interest in new technical developments in the field of commercial and industrial refrigerating, recent Governmental policies particularly affecting durable goods industries, the codification of the Refrigerating Machinery Industry, whose code is now actively in operation and the opening up of attractive export sales fields for refrigerating equipment, the annual meeting was one of the largest and most interesting in the history of the association.

W. S. Shipley, president of the association and head of the York Ice Machinery Corp. of York, Pa., in his opening address stressed the necessity for stimulating confidence in the minds of investors and business men by the balancing of the National Budget and some certainty as to the future stability of the dollar.

Mr. Shipley, in retiring from the presidency was presented with a barometer on behalf of the members of the association. D. Norris Benedict, vice-president and general manager of the Frick Co., Inc., Waynesboro, Pa., was unanimously elected to the presidency to succeed Mr. Shipley, and J. M. Fernald, general manager, Baker Ice Machine Co., Omaha, Neb., was elected vice-president.

It was decided to hold the spring meeting of the association at Hot Springs, Va., on May 23-25, 1935.

Monsanto Chemical Co. Will Enter Dry Ice Field

THE New England Alcohol Co., Everett, Mass., has signed a contract with the York Ice Machinery Corp. for a complete solid and liquid carbon dioxide plant using the Reich-York process. Byproduct carbon dioxide which is now going to waste in the fermentation unit of the alcohol plant will furnish the raw material for the new project and the new plant will have an initial capacity of 10 tons per day with provisions for doubling that capacity. Ground has already been broken and it is expected that the plant will be in operation in the early part of next year.

The New England Alcohol Co., which was formed in 1933 by Monsanto Chemical Co. and Central Aguirre Associates and which is now operating at capacity, started operations in January of this year. The output of alcohol is being used by Monsanto and its subsidiaries and in the New England market.

American Interests Join English Titanium Project

A NEW concern called the British Titan Products, Ltd. composed of the Imperial Chemical Industries, Ltd., the Imperial Smelting Corporation, the Goodlass Wall and Lead Industries, Ltd., and an American firm was recently organized to manufacture titanium white. A plant has been erected at Billingham-on-Tees, Durham County, and adjoins the works of the Imperial Chemical Industries, Ltd. Ilmenite, the titanium bearing ore is utilized. The plant will employ not more than 100 persons at the start.

New Chemistry Laboratory Planned for Trinity

ALUMNI of Trinity College, Hartford, Conn., are organizing to raise funds for a new chemistry laboratory, the construction, equipment and endowment of which will entail an outlay of $700,000. Plans for the building are being prepared by McKim, Mead, and White, architects of New York, who with Dr. Vernon K. Krieble, Scoville Professor of Chemistry, have recently completed a study of chemistry laboratories in other colleges.

An anonymous donor has given $400,000 to construct the building. The alumni now seek to raise, by Dec. 1, $100,000 for equipment and $200,000 as an endowment to provide for operating expenses.

Chemical Alliance Holds Annual Meeting

AT THE annual meeting of the Chemical Alliance, Inc., held at the Hotel Waldorf-Astoria, New York, on Nov. 5, W. B. Bell in delivering the president's address spoke on the subject "The Road to Recovery." In particular he stressed the achievements of American industry during its existence and pointed out the prejudice and antagonism being created today by the spread of doctrines which were both unsound and untrue.

Dean Clark, code director, delivered a report on the work of the Alliance and of his office during the past year.

At the luncheon meeting an informal discussion took place among all the members present of various problems facing the industry. Francis P. Garvan, president of the Chemical Foundation and a guest of the Alliance at the meeting, discussed "Trade Treaties From the Viewpoint of the Chemical Industry." Other speakers taking part in the discussion were Lammot duPont, C. S. Ching, Charles Stone, E. M. Allen, John Garvin, H. L. Derby, N. M. Albright, and Charles Belknap.

At the business session a board of directors was selected which at a subsequent meeting elected officers and an executive committee. The executive committee, in accordance with the Code of Fair Competition for the Chemical Manufacturing Industry, also serves as the Code Authority for that industry.

Officers elected for the ensuing year are: W. B. Bell, president; Lammot duPont, Chas. Belknap, Willard H. Dow, vice-presidents; J. W. McLaughlin, treasurer; and W. N. Watson, secretary.

Members of the executive committee include: W. B. Bell, E. M. Allen, Chas. Belknap, Horace Bowker, M. F. Chase, Willard H. Dow, Lammot duPont, Glenn Haskell, Geo. W. Merck, August Merz, J. W. McLaughlin, and A. E. Pitcher.

Mobile Paper Mill to Use Southern Pine Pulp

PRODUCTION of white paper from Southern pine pulp will be initiated by the Mobile Paper Mills, Mobile, Ala., according to announcement by R. E. Hartman, company president, who stated orders for machinery had been placed. The company has been utilizing pulp imported from Sweden. The company had already completed successful tests with Southern pine pulp supplied by Dr. Charles Herty, of Savannah, Ga. An investigation of the feasibility of manufacturing newsprint paper from Southern pine pulp is now being conducted by the Southern Newspaper Publishers Association.

Power Show Will Display Research Developments

RESEARCH progressively carried forward while production was at a standstill has accomplished results which the average engineer has not yet had opportunity to assimilate. The Power Show to be held at Grand Central Palace, New York, Dec. 3-8, which occurs simultaneously with the American Society of Mechanical Engineers' Meeting, will reveal the latest developments in every phase of power economy and machine efficiency. From the generation of power, through its transmission, in every phase up to the final machines which manufacture the products, literally in every phase of mechanical industry, the pageant of mechanical engineering progress will be complete.

In the field of piping, for instance, amalgamated products will be featured, including lead lined and antimonial lead products for the handling of corrosive liquids. For the handling of acetic acid, citric acid, distilled and carbonated drinking water, lines of block tin will be exhibited. Brass and copper pipe lined with block tin will introduce the subject of tin lining homogeneously bonded to copper. Fittings and valves will be included in the range of lead, tin lined brass and copper as well as iron specialties.

Power machines for pipe threading and cutting, also hand operating units for the same purpose will be related to an exhibit of interest to oil men, namely, rock drill rod threading machines which will cut threads by hand or power for detachable Jack Bits. Valve reseating machines will be shown in operation. In addition to these machines which reseat globe valves, gate valves, and pump valves, there will be automatic separators for removing water and oil from compressed air lines. Packing material will be the subject of two comprehensive exhibits in which packing materials made from rubber, asbestos, flax, cotton, and various metals will be shown for every industrial requirement. A comprehensive exhibit of industrial gaskets and packings will embody new features of construction to gain the ultimate efficiency under modern service conditions.

The modern trend of steam plant equipment will be represented by new steam traps and boiler feeders. Accessories will include steam and oil separators, alarm type water columns, safety gage glass protectors and illuminators. Steam draining devices will reveal interior construction by means of operating models equipped with glass windows to show how they function. One glass model of a steam trap operating at five pounds pressure will demonstrate how the unit can handle air and sludge as well as condensate. For the more economical use of steam in the process industries and the heating of buildings the Exposition will include a wide variety of steam traps, temperature regulators, strainers, pipe savers, and heating specialties. Seamless Muntz metal condenser tubes and condenser tubing ferrules will be the feature of one exhibit while another old line company will center its demonstration on expansion joints for steam lines, exposed and underground, precast concrete conduits and copper hot water boilers for power plants and of interest to the heating and plumbing fields. Other items will include aftercoolers for compressed air, air steam separators, and rotary pressure joints.

Gas Association Criticises Policies of T.V.A.

MORE than 4,300 registered members and guests participated in the convention and exhibit of American Gas Association at Atlantic City, Oct. 28-Nov. 2. Most evident in the general sessions of the convention was the militant spirit of the industry, particularly its attitude toward governmental participation in power and utility business and its sharply critical resolutions concerning the policies of Tennessee Valley Authority.

Though slightly smaller than the last exhibition three years ago, the display of gas machinery and appliances represented a comprehensive group of exhibitors. Notable among these exhibits of interest to chemical engineers were the facilities for which numerous recent sales have been made in chemical plants. In fact, among recent chemical-engineering construction work, a number of the companies commonly thought of as gas-engineering contractors, have had an important part.

Newly elected officers are president, P. S. Young, Public Service Electric & Gas Co., Newark, N. J., and vice-president, L. B. Denning, Lone Star Gas Co., Dallas, Tex. The chairman and vice-chairman of the Technical Section are, respectively: C. A. Harrison, gas engineer, H. L. Doherty & Co., New York City, and F. A. Lydecker, general superintendent of gas distribution, Public Service Electric & Gas Co., Newark, N. J.

Award of the Charles A. Munroe medal in recognition of achievements advancing the gas industry was made to Henry O. Loebell of Chicago, general sales manager of Natural Gas Pipe Line Co. of America. The Beal medal award for the best technical paper presented at the association's convention during the previous year was made to Walter H. Fulweiler, chemical engineer, United Gas Improvement Co. Mr. Fulweiler's paper reported on his investigations of gum formation in gas.

Equipment Institute Elects Officers

AT ITS Second Annual Meeting, Oct. 16, at the Chemists' Club in New York, James E. Moul, general manager of Turbo-Mixer Corp., New York, was elected president of the Chemical Engineering Equipment Institute. The other officers elected at the same time were H. D. Miles, president of Buffalo Foundry & Machine Co., Buffalo, and William Edwin Hall, president of The Duriron Co., New York and Dayton, as vice-presidents, and D. H. Killeffer, secretary-treasurer.

The Board of Directors of the Institute elected at this meeting is as follows: James E. Moul, Turbo-Mixer Corp., H. D. Miles, Buffalo Foundry & Machine Co., W. E. Hall, The Duriron Co., Samuel Alsop, Alsop Engineering Co., C. L. Campbell, E. B. Badger & Sons Co., J. V. N. Dorr, The Dorr Co., Howard Farkas, United States Stoneware Co., L. H. Harvison, The M. W. Kellogg Co., Percy C. Kingsbury, General Ceramics Co., L. P. Sharples, Sharples Specialty Co., S. F. Spangler, Chemical Construction Corp., and Arthur Wright, Arthur Wright & Associates.

The Code Authority of the Chemical Engineering Equipment Industry (a subdivision of Machinery & Allied Products Industry) was constituted of the foregoing board of directors as representatives of the Chemical Engineering Equipment Institute together with M. J. Sayles of Independent Filter Press Co., Brooklyn, and Franklin Wedge of Electro-Chemical Supply & Engineering Co., Paoli, as representatives of those firms in the industry not members of the Institute. The Administration members of the Code Authority of the Industry are Daniel L. Morris and Francis E. Lee. Mr. Moul and Mr. Killeffer were elected chairman and secretary, respectively, of the Code Authority.

New Plant for Titanium Oxide Production

THE American Zirconium Corp. will shortly commence operations at its Baltimore plant. Titaniun oxide will be produced. The plant will be operated by the Chemical & Pigment Co. of Baltimore of which Herbert L. Rhodes is local manager. The Zirconium corporation will operate on some rather novel, new methods developed by the engineering and research staff. The American Zirconium Corp. is partly owned by the Glidden Co., Cleveland, Ohio, and the Metal & Thermit Corp., New York. The officers are: president, Adrian D. Joyce; treasurer, R. H. Horsburgh, and vice-president, Fred W. Cohen.

NEWS FROM WASHINGTON

By PAUL WOOTON

Washington Correspondent of Chem. & Met.

"THE NRA is not on its way out—but is on its way up. It is growing stronger every day. . . . The recovery of recovery is under way." Thus Donald Richberg, key man in reorganization, served notice on the convention of the paint, varnish and lacquer industry that the NRA is here to stay. He stated flatly, however, that no major operation is contemplated, that NRA may be expected to improve considerably under constitutional treatment. In other words, that there will be no administrative "big stick," no effort to bind substantial minorities to the opinions of majorities concerning what are just or wise business practices.

"If we are to write industrial law, we must write it as all other sound law is written, as the translation into a compulsory rule of a custom so well established that it has almost universal support," Mr. Richberg declared. "We must be sure that even then such a rule does not invade any equally well-established concept of a minority right to be free from majority compulsion. Trade laws need more solid foundations than trade agreements. When codes have been written or when they are revised in conformity with these principles the problem of compliance will be much simplified and greater assurance of uniform enforcement can be expected from all arms of the government—including the judicial."

Mr. Richberg admitted that so long as grave uncertainties or inconsistencies existed within NRA as to its policies, the task of the Federal Trade Commission and the Department of Justice, as cooperating agencies, was difficult to say the least. Now that consistency and legal precepts will be given some weight in code-making and code enforcement, Richberg claims that a "very good understanding" has been reached with the Department of Justice. He attributed NRA's tribulations to date to an attempt to move too rapidly in the direction of ideal business and labor conditions. These remain the objective, but the policy now will be to move slowly, step by step, as precedents are established in a comparatively new field of law. This will be acceptable to a majority of the coded industries who sincerely desire to retain rules on what constitutes fair and unfair trade practices that, in many cases, date back to codes drafted, in the first instance, under the auspices of the Federal Trade Commission.

Regulations governing the transportation of explosives and other dangerous articles by water have been issued by the Interstate Commerce Commission, effective Feb. 1, 1935, and, permissibly, at once. A code is prescribed for stowage on vessels and the handling of products also covered in the regulations for rail transportation. Packing, marking and labeling requirements are the same for both rail and water and uniformity in this respect also will be observed in the regulations governing transportation by motor vehicle, soon to be issued in their final form.

A development of the concentrated attention which has been given soil erosion during the past year has led to the conclusion that grass is one of the most efficient agencies in preventing soil deterioration. It has an advantage over tree planting in that it can be grown at small cost within a single year. Phosphate fertilizer is essential to the proper growth of grass in erosion control. This is seen in Washington as holding great significance for this branch of the fertilizer industry as enormous quantities of phosphate would be needed if the soil erosion program goes forward on the scale now intended.

The looming of this possibility has intensified the controversy over the phosphorus plants at Muscle Shoals. TVA officials contend that this is nothing more than a large scale experiment and that the apprehensions of the private fertilizer industry are not justified.

Chemists in Washington see in this development a great opportunity for super-phosphate if a real effort is put forward to effect economies in the acid-making process as well as in distribution. It is pointed out that it is yet to be proven that either furnace at Muscle Shoals will make phosphoric acid cheap enough to make it possible to use it as plant food in competition with the more advanced methods of manufacture by the acid process.

Zinc, used in fertilizer or as a spray, has been found to be effective in checking plant diseases that have threatened for many years tree crops of the extreme Southern United States, and have cost farmers millions of dollars.

The Florida State Experiment Station has discovered that use of the element will correct bronzing of tung oil trees, which several years ago threatened to stop development of that industry in the State; frenching or mottle-leaf of citrus, rosette of pecan and white bud corn.

Findings from the Experiment Station's investigations have been so convincing in certain areas of the State that growers are already using large amounts of zinc, it is reported. While both use of the element in fertilizer and as a spray has proven effective, for citrus trees, the spraying is recommended as more practical and better.

In the movement toward decentralization of industry, which is generally predicted, and which certain Administration officials hope they can help foster, manufacturers of paints, varnishes and allied chemical products will do well to look to the South. This is the opinion of Government trade experts familiar with those industries. Besides placing these trades closer to their raw materials, turpentine, rosin and tung oil, the Southern movement offers possibilities of placing the manufacturers closer to present available export markets through Gulf ports.

With the approval of the electorate evidenced by this month's voting, the New Deal will now attack the major business problems of budget making, taxation, and social insurance. An elaborate program of legislation is being formulated in Washington for presentation in January when the new Congress will convene. At that time also there will be ready for the legislators Presidential recommendations regarding the basis on which N.R.A. and A.A.A. activity will be extended, for no one doubts that both these two leaders of New Deal practice and many other alphabetic agencies are to be remodeled and strengthened for continued service. Even some of the special tariffs, on copper, petroleum, and other important industrial commodities, must receive attention because they expire by limitation next June.

Chemical industry executives are, of course, more immediately concerned with the labor adjustment projects than with any others active in Washington. In this field, however, the attitude of labor organizers is perhaps just as important as that of public officials. Some believe, in fact, that New Deal leaders have lost much of their zeal for the support of nationally organized bargaining as they have come closer and closer to realities in this field. Even if this be true, however, there is no ground for anticipating anything but continued pressure on the broad principles which are required by the famous Section 7a of N.I.R.A. "Collective bargaining" will continue to be a demand of government, as well as of labor leaders.

NEWS FROM ABROAD

By Special Correspondents of Chem. & Met. at Berlin and London

BERLIN

THE question of raw materials is the most vital in German technique at the present time. However, the demand for German raw materials is not entirely the result of a need of preserving exchange but is brought forth by the prevalent thought, as far as possible, to produce German goods from German raw materials. In the first rank is found the question of producing solid, liquid, or gaseous motor fuel from domestic coal or crude oil. While in 1933 only a fourth of the domestic requirement of liquid motor fuel could be covered from German production, during the coming year more than two-thirds of the estimated requirement of 2,200,000 metric tons of motor fuel, including diesel oils, will be supplied from domestic sources, as follows: benzol, 400,000 tons; alcohol, 400,000 tons (by raising the quantity of industrial alcohol specified by law as addition to motor fuels to 20 per cent); diesel oils and gasoline from increased production of oil and lignite tar resulting from full utilization of present distillation capacity, 300,000 tons; gasoline from hydrogenation of coal, 400,000 tons (completion of present and projected plants); a total of 1,500,000 tons. To increase the production of gasoline from lignite the government has lately induced the lignite producers to form an economic association.

It has not yet been decided if the method used will be distillation or the hydrogenation process developed by I.G., which firm is itself one of the largest lignite producers in Germany. Decision has not yet been made how the individual firms will participate in the association, but a contribution of 2 Rm. per ton produced is expected, or a total of about 250,000,000 Rm. The methods will also be considered by which a high recovery of ash-free extracts is made from the coal by pressure extraction, from which their liquid fuels may be produced. Particular attention will also be given to gases. As Tränckner stated at the Essen mining convention, the substitution of gaseous for liquid motor fuel has been technically solved. Its advantages over liquid fuel is cleaner combustion, no contamination of the lubricating oil, and instant starting of the motor in the coldest weather. The cost of changing a motor to gas, exclusive of the price of the flasks, is about 350 Rm. In Germany the following gases are available from coal distillation: methane, coke oven gas, city gas, Ruhr gas; propane and butane, byproducts from coal hydrogenation and petroleum cracking, about 75,000 tons. By rational development of the plants these quantities may be increased to the point where 200,000 tons of gasoline may easily be replaced. However, with propane and butane it is only possible to drive for 100-150 km. without refueling, whereas 300 km. may easily be made with methane and other gases. Passenger cars may also be driven with butane, propane, and Ruhr gas.

At the general meeting of the Metallurgical and Mining Society Professor Kessner pointed out that many nonferrous metals may now be replaced by zinc and aluminum alloys and partly also with iron or non-metallic materials. However, for electrical machinery and apparatus such substitution is frequently not possible. The new development is responsible for an increase in the German production quota, from 40,000 to 55,000 tons of aluminum annually, at the recent conference of Alliance Aluminium.

The successful synthesis of artificial asbestos reported by Lüdke and Scheumann at the meeting of the German Mineralogical Society also deserves serious attention. Synthesis of hornblende, the raw material for asbestos, was accomplished in 1932. Although only comparatively short fibers have been produced they have proved satisfactory for the production of high grade asbestos products.

LONDON

WHILE the process of recovery is only just becoming noticeable, as usual the Stock Exchange barometer has risen well ahead of actual basic facts. Improvement is perhaps least noticeable in the chemical industry, which throughout the depression has succeeded in keeping its head well above water. The iron and steel industry and the sulphuric acid industry are probably the most reliable index, and although the impetus due to the artificial stimulants of devalued currency and import tariffs have nearly spent their force, the time given for industry to put its house in order is likely to enable the improvements already registered to be fully maintained.

Export trade is still severely hampered, and it is on this as much as upon returned confidence and enterprise that the future is likely to rest, always provided that America participates in such recovery, and that the threatened stoppage in the South Wales coal mines does not materialize.

The face of London and of most large towns has been greatly altered in the last few years by reconstruction of old buildings and the erection of new offices and the completion of housing schemes. This process shows no sign of abating, and is beneficial not only to other industries, but will in the long run tend to reduce labor troubles and banish the picture of communism, inasmuch as today even the humblest worker is becoming the owner of his house and therefore a small capitalist. Similarly, the worker is becoming a shareholder in industrial concerns, and there is a definite revival in the idea of saving and thrift.

The number of new factories and enterprises is relatively small, but the trend in this direction has been assisted not only by the import duties, but also indirectly by the migration of "non-aryan" scientists and technologists from Germany, many of whom have already been instrumental in starting and developing new industries and particularly chemical and allied processes in this country. One new enterprise inspired this time from the United States, is the successful flotation of a company, with a capital of 1½ million dollars, to manufacture and refine lubricating oils in this country by the Duo Sol Solvent refining process. The chairman and managing director is Herbert Green, who in the past has been prominently connected with the industrial solvents and distilling industry of this country, and a factory capable of producing about 40,000 tons of finished lubricant is to be erected immediately in Lincolnshire, and operated under British Patent No. 355,294 under license from the Royal Dutch Petroleum group; the annual profits are estimated at $600,000.

Palestine Potash, Ltd., has now doubled its plant capacity and this year 130,000 tons of crude potash were harvested. Bromine sales also expanded and about 500 workmen are employed, among which no serious case of illness has been reported. Scarcity of skilled and semi-skilled labor is still a difficulty owing to the rapid industrial expansion of Palestine in other directions, which incidentally caused a rise in wages in building and in new industries, which tended to take away the company's workmen.

NAMES *in the News*

CLARK C. HERITAGE, who for several years has been manager of the Maine Coated Division of the Oxford Paper Co., has been made technical director of the company, including the Maine Coated Division and the Oxford-Miami Paper Co. Mr. Heritage is president of the Technical Association of the Pulp & Paper Industry.

GEORGE O. CURME, vice-president of Carbide and Carbon Chemicals Corp., has been awarded the Perkins Medal for 1935 by the American Section of the Society of Chemical Industry. The award goes to Dr. Curme for his research work in the field of organic synthesis. Selection was made by a committee representative of five of the national chemical societies. Presentation of the medal to Dr. Curme will be made at a meeting at the Chemists' Club in New York on Jan. 11, 1935.

George O. Curme

FLOYD J. METZGER, director of the research laboratories of the Air Reduction Co., the U. S. Industrial Chemical Co., and the U. S. Industrial Alcohol Co., has been awarded the Chemical Industry Medal in recognition of the valuable results of research in the field of gases, which has been carried out under his direction. Dr. Arthur D. Little, as a past-president of the Society of Chemical Industry made the presentation. Dr. Metzger then presented his medal address on the subject, traces from tons.

Floyd J. Metzger

RALPH GIBBS has become associated with John E. Baker Co. of York, Pa., where he will be in charge of research, development and control work. Soon after graduating from Pennsylvania State College in 1921 Mr. Gibbs joined the York Manufacturing Co. and two years later was made chief chemist, a position he held until joining the Baker organization.

HERMAN VON SCHRENK, consulting engineer of St. Louis, has been elected president of the American Society for Testing Materials to fill the vacancy caused by the death of W. H. Bassett. H. S. VASSAR assumed the office of senior vice-president and A. C. FIELDNER was elected junior vice-president.

J. T. SHILLINGFORD, formerly of the process division of the DuPont Cellophane Co., is now with Whitehead Metal Products Co., a subsidiary of International Nickel Co. Mr. Shillingford is located in New York.

CHARLES A. NEWHALL, consulting chemical engineer of Seattle, is serving as sanitary engineer for the newly organized Grande Coulee District of the Washington State Department of Health.

F. M. HAINES is now an assistant professor in the chemical department of the Georgia School of Technology.

W. O. HISEY is now an instructor in pulp and paper at the New York State College of Forestry. Formerly Mr. Hisey was with the P. H. Glatfelter Co.

JOHN J. MCNAIR, formerly at the University of Idaho School of Forestry, has joined the pulp division of the Weyerhaeuser Timber Co. as chemist.

JAMES W. FURNESS has been named chief of the Economics Branch, Bureau of Mines, assuming his duties in this new post October 20. Mr. Furness was formerly in the Bureau of Mines for 5 yr., but for approximately the last 7 yr. he has been chief of the Minerals Division, Bureau of Foreign and Domestic Commerce. Previous to that he had been widely known in mining and mineral industries, where he had 27 yr. operating experience and acquaintance with many and varied economic problems.

ROBERT N. WENZEL is the incumbent of the industrial fellowship founded by the Onyx Oil & Chemical Co. at Mellon Institute. Dr. Wenzel is concerned with the investigation of problems in textile processing and finishing.

WILLIAM J. BALDWIN has been appointed to work with JACK H. WAGGONER on the O. Hommel Co.'s fellowship at Mellon Institute.

JOHN URI LLOYD was honored at a special ceremony at the Philadelphia College of Pharmacy and Science in recognition of his many and varied contributions to chemistry and pharmacy. Dr. Lloyd was presented the Procter International Award.

K. E. BUFF has left the Institute of Paper Chemistry to join the Owens Illinois Glass Co. He will serve the Illinois company as chief chemist.

W. J. PARKS, formerly chemist for the Cresta Blanca Co. of San Francisco, is now superintendent of the Hedgeside Distillery at Napa, Calif.

JEAN JACQUES SCHREURS, graduate of the University of Brussels, is holder of the fellowship of the C.R.B. Educational Foundation for study in the United States during the year 1934-35. He has registered at Columbia University and is specializing in electrochemistry under Prof. Colin G. Fink.

FREDERICK E. SCHMIDT, who joined the staff of A. A. Lund and Associates of New York several months ago has been made production manager. Lansing T. Dupree and Sidney A. Johnson are new additions to the staff.

CARL APELGREN is associated as chief chemist with St. Regis Paper Co. at Deferiet, N. Y. He was formerly with Taggert Bros. Co.

W. H. FISHER has resigned as chief chemist for the Florida State Road Department to accept a position as automotive engineer with the Gulf Refining Co. at Atlanta.

S. A. PELLERANO, formerly chief chemist for the Garfield Manufacturing Co., of Garfield, N. J., and A. J. RISSETTO, formerly with Zonite Products Corp., have entered into business as consulting chemists and chemical engineers under the firm name of Associated Industrial Chemists, at Brooklyn, N. Y., specializing in pharmaceuticals, synthetic resins and plastic compositions.

HARRY L. DERBY, president of American Cyanamid & Chemical Corp., will serve as chairman of the chemical and paints division of the commerce and industry committee of the Citizens Family Welfare Committee of New York.

OBITUARY

D. E. BADGER, chairman of the board of E. B. Badger & Sons of Boston, died at his home in Winchester, Mass., October 3. He was 84 yr. old, and had been associated with the company bearing his name since he was 16 yr. old.

Starting in as an apprentice with the coppersmiths, Hicks & Badger, as the firm was then called, he worked his way up through various positions until 1879 when he became a partner and the name of the company was changed to E. B. Badger & Son. In 1900 he became vice-president. Later he was made president and less than a year ago was made chairman of the board.

J. R. COLBY, president of the Liquid Carbonic Canadian Corp., Ltd., died October 7, at Montreal. When the Canadian Section of Compressed Gas Manufacturers' Association was organized in 1921, Mr. Colby was elected chairman. In recognition of his services to the compressed gas industries he was elected president of Compressed Gas Manufacturers' Association for the year 1930.

CHARLES B. JACOBS died October 18 in the Waterbury Hospital of pneumonia. He was 64 yr. old. Mr. Jacobs was known for his metallurgical work for which he received the John Scott Medal in 1914 from the Franklin Institute.

J. LAURENCE GILSON died at his home at Irvington-on-Hudson, N. Y., on October 4. He was 53 yr. old. After graduating from M.I.T. and Yale he entered the cane sugar industry. Later he joined the chemical department of E. I. du Pont de Nemours & Co. and in 1921 became associated with the United Lead Co. At the time of his death he was vice-president of the Manufacturers Trust Co.

JOSEPH F. MCGREGORY, head of the department of chemistry at Colgate University until his retirement several years ago, died at Hamilton, N. Y., October 14. A week before his death he had been struck by an automobile. Dr. McGregory had been associated with the department at Colgate almost from the time of his graduation from Amherst College in 1880.

William N. Toschach, chief research chemist for the Great Atlantic and Pacific Tea Co., died October 16 at Brooklyn, N. Y. Mr. Toschach joined the A. & P. organization more than 30 yr. ago.

Harry L. Derby, president of American Cyanamid & Chemical Corp., C. M. Brown and Raymond Pitcairn of the board of Pittsburgh Plate Glass Co., eat a meal of barbecue on the King ranch in Texas. They were in Corpus Christi for the opening of the Southern Alkali Corp. plant

CALENDAR

AMERICAN INSTITUTE OF CHEMICAL ENGINEERS, fall meeting, Pittsburgh, Pa., Nov. 15-17.

NATIONAL EXPOSITION OF POWER, Grand Central Palace, New York, Dec. 3-8.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE, Pittsburgh, Pa., Dec. 27-Jan. 2.

AMERICAN CERAMIC SOCIETY, Buffalo, week of Feb. 17.

ELECTROCHEMICAL SOCIETY, New Orleans, Mar. 21-23.

AMERICAN CHEMICAL SOCIETY, New York, week of Apr. 22.

EXPOSITION OF CHEMICAL INDUSTRIES, New York, week of Dec. 2-7, 1935.

DR. CARL L. VON ENDE, head of the department of chemistry at the University of Idaho, died October 8, at his home in Moscow, Idaho. He was 64 yr. of age.

Dr. von Ende studied at the University of Idaho and the University of Goettingen. For a short period he was an instructor at the Massachusetts Institute of Technology.

CALVIN W. RICE, executive secretary of the American Society of Mechanical Engineers for the last 28 yr., died October 2 in New York of a cerebral hemorrhage. He was 65 yr. of age. Mr. Rice became permanent secretary in 1906 and since that time has been the guiding force of the organization.

ROSS CAMPBELL, chief chemist of the pulp division of the Buckeye Cotton Oil Co., Memphis, died on October 13 after an illness of two weeks. He was 42 yr. old. Mr. Campbell is a graduate of Massachusetts Institute of Technology. Before going South he was employed by the American Writing Paper Co. as research chemist. His interest has been principally centered in the problem of producing rayon and similar products from cotton linters.

WALTER J. KEITH, professor of organic chemistry at Pennsylvania State College, died September 3, at Bangor, Maine.

FRANK JULIAN SPRAGUE, who for many years has been associated with the electrification of elevators, street railways and steam railroads in several countries, died October 25. In recognition of his many developments he was awarded the Franklin Medal and the Elliott Cresson Medal of the Franklin Institute. A few days before his death Dr. Sprague was awarded the John Fritz gold medal for 1935.

LUDINGTON PATTON, vice-president and director of the Pittsburgh Plate Glass Co., died of a heart attack October 20, at River Hills, Wis. He was 63 yr. of age. In 1919, when the Patton Paint Co. became affiliated with the Pittsburgh company, he was made director of that organization. Mr. Patton was head of the paint and varnish division of the firm.

SAMUEL P. MULLIKEN, professor of organic chemistry at Massachusetts Institute of Technology, died at his home in Newburyport, Mass., October 24. During the War Dr. Mulliken conducted many important developments on war gases for the government. He was graduated from M.I.T. and later studied at Leipzig and for more than 40 yr. has been connected with the Institute.

Southwestern Alkali Industry Gets Underway

By *CHEM. & MET.* NEWS CORRESPONDENT

THE first alkali works in the Southwest is now in operation; a second plant is about ready to start producing; and the third new alkali project of that section promises to be completed in the Spring. These announcements briefly sum up the progress made in the movement to develop an alkali industry in the far South and Southwest.

Of the three new projects, the Southern Alkali Corp. was the first to get underway. The new plant of the corporation was officially opened on Oct. 26 when officials of the two parent concerns—American Cyanamid Co. and Pittsburgh Plate Glass Co.—were in Corpus Christi, Tex. to join in the festivities incident to the opening.

Its president, Hugh A. Galt, of Akron, Ohio, who is also a vice-president of the Pittsburgh Plate Glass Co., predicted an extensive development of the chemical industry in the South within the next decade. Harry L. Derby of New York, president of the American Cyanamid and Chemical Corp., said that an adequate home supply of basic alkalis had been a recognized need of many Southwestern industries for many years.

Other prominent industrialists here for the opening included Dr. W. S. Landis of New York, vice-president of American Cyanamid; Clarence M. Brown, chairman of the board of Pittsburgh Plate, and Raymond Pitcairn, capitalist, of Philadelphia; Dr. M. C. Whittaker and K. F. Cooper, both of New York, and vice-presidents of American Cyanamid, and Eli Winkler of New York, sales director for Southern Alkali. A number of events had been arranged for the entertainment of the industrialists, including a barbecue on the world-famous Santa Gertrudis ranch, owned by the King estate, and which incompasses 1,250,000 acres of South Texas land.

While company officials are loath to discuss progress in the construction of the chemical plant of the Mathieson Alkali Works at Lake Charles, La., it is understood from authoritative sources that the cost of the project will more closely approximate $8,000,000 than the estimated $7,500,000. In September it was stated by E. M. Allen, corporation president, that operation would begin in October with shipments to start in December while in a recent interview given in Lake Charles, E. A. Hults, vice-president and manager of operations, said operations would begin around the end of November with shipments scheduled for the beginning of the year.

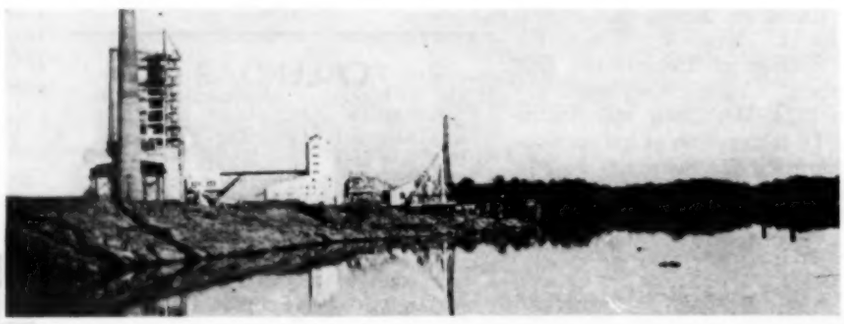
As November opened, the corporation awarded a contract to the Louisiana Materials Co., Baton Rouge, La., for the dredging of a 30 ft. channel to the site of the proposed 450 ft. steamship dock and for an 82,000 bbl. fuel oil tank. The 30-foot channel and docks are to cost $100,000, which will be additional to the estimate on the plant.

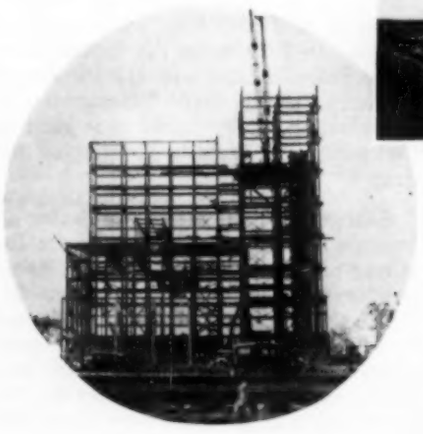
The plant, it is understood, will have a daily productive capacity of 600 tons, and will fill all export orders of the company.

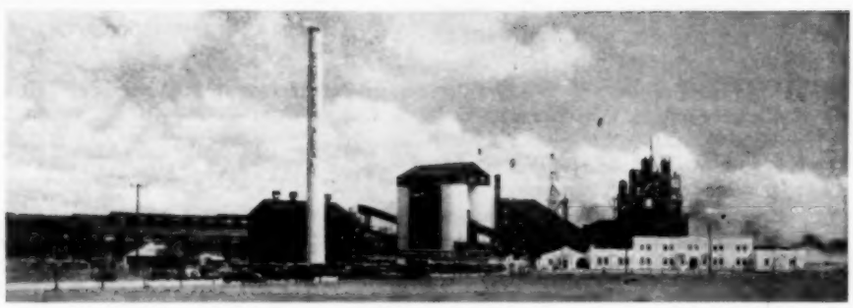
The accompanying photographs, taken on Oct. 29, show the progress achieved in the construction of the alkali plant of the Solvay Process Co., at Baton Rouge, La. The steel framework of the 11 story main building has advanced several floor levels and the external part of the office and laboratory has been completed. Construction is slated for completion during the coming spring. Construction employees have been drawn, as far as feasible, through local sources this agreement having been reached as a result of the contribution by local interests of $40,000 to bring the plant to Baton Rouge.

STATUS OF ALKALI PLANTS IN THE SOUTHWEST

Below—Framework of main building of Solvay Process Co. Below, right—Finished plant of Southern Alkali Corp. Above—Plant of Mathieson Alkali Works nearing completion.







Sales of Crude Arsenic Gain at Expense of Refined

DELIVERIES of domestic arsenic during the first nine months of the present year indicate that there has been a definite trend toward the use of crude arsenic without putting it through a refining process. In fact, the statistics reveal that for the first three-quarters of this year deliveries of the crude product to consumers actually exceeded the amount shipped to refiners.

In recent years there has been a tendency to convert crude arsenic directly into sodium arsenite, which is used for sheep dips and insecticides.

Production of calcium arsenate also has been effected from crude arsenic and the larger amount of the crude product consumed as such this year is attributed to the larger use of agricultural and insecticide chemicals.

The United States Bureau of Mines in reporting on production and sales of white arsenic in 1932, divided the domestic output on a basis of 71 per cent used in manufacture of insecticides; 11 per cent for weed killers, fungicides, and wood preservatives; 2 per cent in manufacture of glass; and the balance —about 16 per cent—sold for export.

Total consumption of arsenic in this country in the current year is on a rising scale. In the first place domestic production of crude arsenic for the first 9 months of 1934 was almost as large as the total output for 1933, the figures being 10,014 short tons and 11,189 short tons, respectively. In addition stocks have been drawn upon as is shown by the fact that at the beginning of this year stocks of crude were reported at 4,788 tons, while at the end of September only 2,328 tons were held in stock.

Production of refined arsenic has fallen off materially this year. For the 9-month period ended Sept. 30, the output was 4,629 tons, which compares with 6,139 tons for the corresponding period of 1933 and with 8,185 tons for all of 1933. Stocks of refined arsenic which stood at 3,851 tons on Jan. 1, 1934, had fallen to 1,436 tons by the end of September.

In reporting on the arsenic industry for 1933, the Bureau of Mines stated that production of arsenious oxide (white arsenic) in the United States dropped in 1933 to 10,650 short tons—the smallest quantity since 1926. Approximately two-thirds (7,181 tons) was refined, and the remainder (3,469 tons) was crude.

Sales of refined and crude arsenic amounted to 11,797 tons valued at $636,132. Approximately 75 per cent (8,768 tons) was sold as refined white arsenic, for $489,549, and the remainder (3,029 tons) was sold as crude arsenic, for $146,583.

No revision was made in the price of 4c. a lb. for white arsenic delivered at New York, in barrels. This quotation has become a fixture since 1927. The average receipts actually obtained from sales by producers in 1933, as reported to the Bureau of Mines, were 2.80c. per lb. for refined and 2.40c. for crude arsenic. These prices, of course, do not include freight. The averages reported in 1932 were 2.67 and 2.28c., respectively.

The price position weakened in October this year when producers announced their willingness to accept business on a basis of 3½c. a lb. delivered to consumers plants.

In 1933, imports of white arsenic rose to 10,583 short tons valued at $512,542, the highest figure since 1929; in 1932, only 6,882 short tons valued at $357,991 were imported. Imports from Mexico which formerly furnished the bulk of the foreign arsenic used in the United States showed a gain of a few hundred pounds (4,040 short tons valued at $256,511 in 1933, compared with 3,325 short tons valued at $182,671 in 1932). The greater part of the increase resulted from a sudden influx of shipments from France. Imports of white arsenic from that country rose to 3,810 short tons valued at $117,606. Next in importance was Japan, which furnished 1,338 tons. Lesser quantities were imported from Canada, Australia, Belgium, Germany, and Sweden.

Imports of white arsenic in September amounted to 561 tons, of which 339 tons came from Mexico, 186 tons from Japan, 29 tons from Canada, six tons from Australia, and one ton from Germany. Since 1925 the greater part of domestic imports has originated in Mexico and has come from American-owned plants.

White Arsenic Sold by Domestic Producers

	Refined Short Tons	Crude Short Tons
1922	8,905	1,122
1923	12,357	1,914
1924	12,270	2,183
1925	11,240	1,077
1926	10,977	828
1927	10,020	1,540
1928	8,115	3,652
1929	9,823	4,723
1930	14,654	2,771
1931	11,982	1,795
1932	10,508	1,975
1933	8,768	3,029
*1934	6,099	6,375

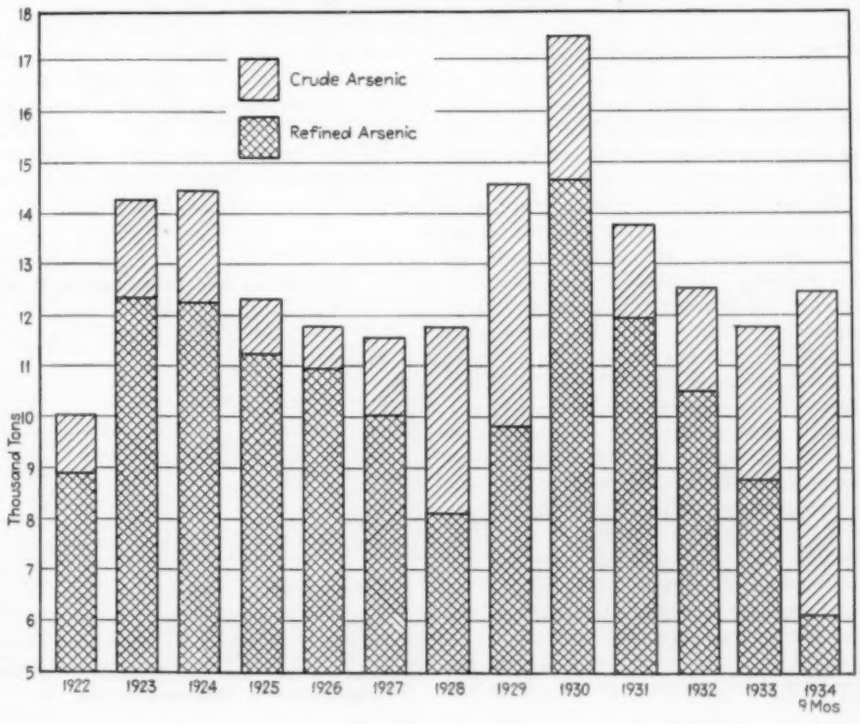
*First 9 months.

Imports of White Arsenic

	Tons	Value
1922	1,081	$ 162,494
1923	10,152	1,985,400
1924	8,877	1,597,433
1925	9,316	1,076,073
1926	7,703	510,227
1927	12,517	921,998
1928	11,153	775,169
1929	13,157	956,176
1930	10,471	725,991
1931	7,791	451,468
1932	6,882	357,991
1933	10,583	512,542
*1934	10,617	.....

*First 9 months.

Domestic Sales of Crude and Refined Arsenic



Chemical ECONOMICS

PRODUCTION of chemicals in the last month was on a larger scale than in the month preceding. Improvement was reported in the position of some of the large consuming industries and this encouraged producers. A large part of chemical manufacture, however, is reported to have gone forward without much change in the rate of production in recent months.

During September the closing of many textile plants adversely affected consumption of chemicals in that industry. A notable pick-up has been reported in the takings of raw materials by the textile industry in October. As an example, statistics released last week show that deliveries of all sorts of raw silk to American mills during October ran 50.6 per cent ahead of September and topped last year by 72.2 per cent. They totaled 49,103 bales, the best total for any month since June, 1933, or 16,507 more than September of this year and 20,585 better than October of last year.

Production of solvents including denatured alcohol and methanol has been higher than it was last year and sales to the anti-freeze trade have resulted in a large movement of these two products from producing points. Production of crude methanol in September was 260,402 gal. which brings the total for the first nine months of this year up to 2,799,542 gal. The September output of refined methanol was 1,079,910 gal. and the nine-month total stands at 8,133,527 gal.

The status of the fertilizer trade may be inferred from a study of production and consumption of sulphuric acid in that industry. Production in September was 115,309 tons against 133,056 tons in September, 1933. For the nine-month periods, production was 1,036,892 tons and 897,465 tons in 1934 and 1933 respectively, or a gain of more than 15 per cent for the present year. Consumption of sulphuric acid in fertilizers in September was 84,993 tons against 92,962 tons in September, 1933. For Jan.-Sept., 1934, consumption reached a total of 962,220 tons with 741,127 tons for the corresponding period of 1933. This represents an increase of almost 30 per cent for the current year.

Sales of paint, varnish, and lacquer for the first three-quarters of this year are reported at an advance of 29.4 per cent over those for the comparable time of last year but the price level was higher this year so a somewhat smaller percentage gain exists if the comparison is one of quantity. This is verified by reports of sales of lacquers alone which amounted to 19,525,678 gal. in Jan.-Sept. 1934 and to 17,410,350 gal. in Jan.-Sept. 1933 or a gain of but little more than 12 per cent. Consumption of linseed oil in industry for the nine-month period was 9.5 per cent above that for last year and China wood oil gained 16.7 per cent.

A notable case where advances in production in the early part of this year were more than offset by curtailed operations in the last few months is found in the figures for plate glass as the nine-month total for this year is below that for the like period of last year. In fact in practically all the chemical-consuming industries, a considerable decline is noted in the percentage increases over last year as shown in the first half and the first nine months, the drop in the third quarter being more than seasonal.

Activities in the coal-tar industry for the first three-quarters of the year are represented by an output of 342,228,192 gal. of tar against 252,856,331 gal. in the corresponding period of 1933 or an increase of more than 35 per cent for the present year. The nine-month output of benzol was reported by the Bureau of Mines at 45,332,000 gal. as against 32,557,000 gal. in the like period of 1933. Recovery of light oils in the same periods amounted to 102,261,105 gal. and 84,621,881 gal. respectively and that of ammonium sulphate or equivalent to 406,001 tons and 321,935 tons.

The movement of goods in the final quarter of this year as forecast by the Atlantic States Shippers' Advisory Board is represented by an increase of 5.9 per cent over the fourth quarter of 1933. Of the commodity groups an increase of 5 per cent is forecast for petroleum and petroleum products, 15 per cent for fertilizers, 1.6 per cent for paper, paper board, and prepared roofing, while a decline of 2.2 per cent is indicated for deliveries of chemicals and explosives. In the case of paints, oils, and varnish, glass containers, and gypsum practically no change is anticipated from the totals for the Oct.-Dec. period of last year.

Free trade zones in the United States are expected to become an actuality about the first of 1935. At least, the committee in the Department of Commerce drafting rules and regulations for their operation hopes to be ready to pass upon applications shortly before then.

In passing the free trade zone law, Congress did not provide for a special agency to administer it or regulate the ports designated under it. Secretary of Commerce Roper set up a committee to draft rules and regulations which has had to borrow its personnel to weave together interests of various departments, such as the Treasury in revenue protection, the War Department in coast protection, and the Bureau of Navigation in shipping safety, in carrying out its work.

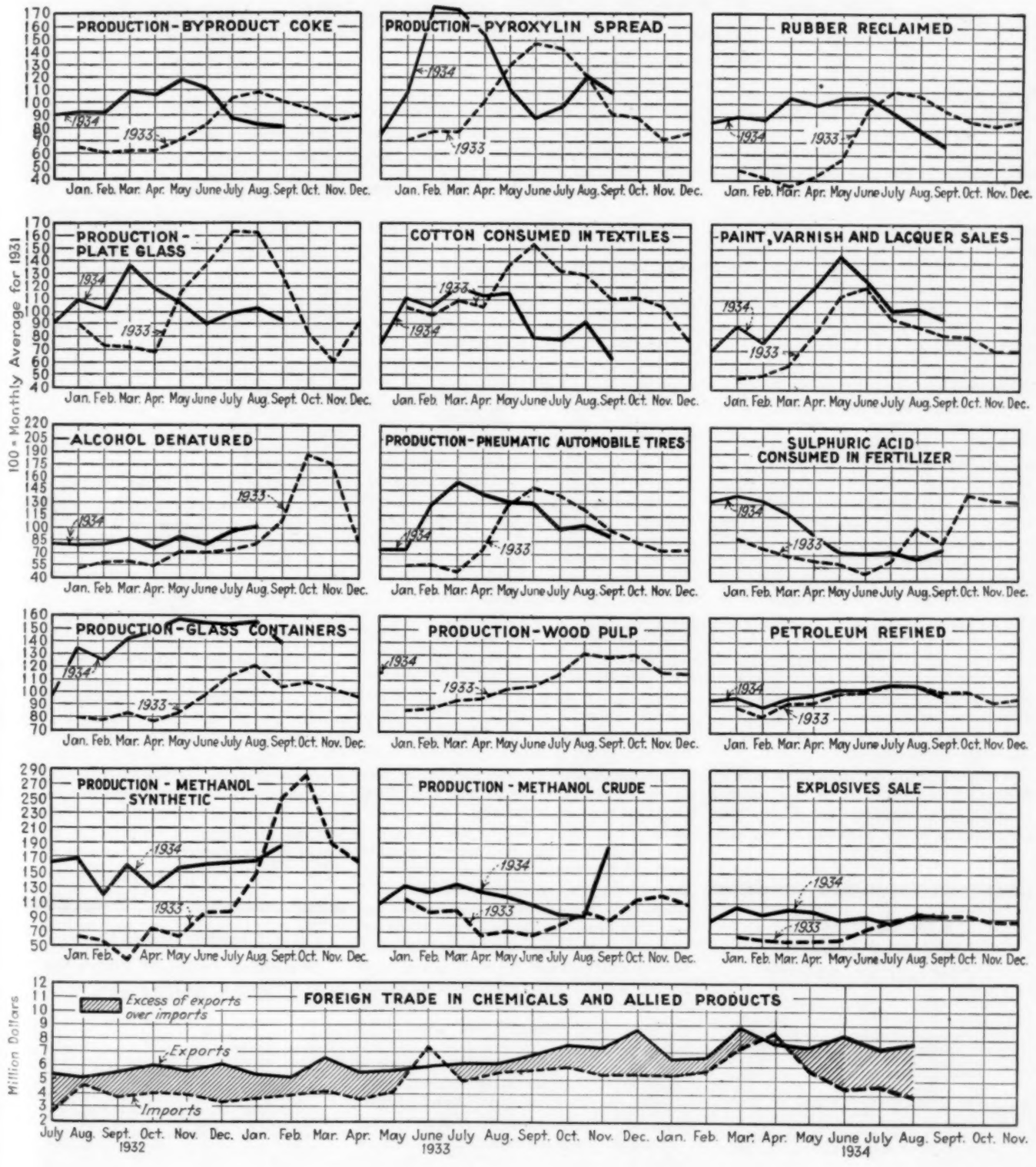
Considerable interest is reported to have been shown by cities throughout the country and by foreign trade interests in the possibilities offered by the new law. About 30 civic, municipal, or industrial organizations have indicated a desire to apply for recognition as free ports so far. Interests from abroad is confined, generally, to forwarders in foreign countries who see in the free trade zones new distribution channels or distributing points.

Production and Consumption Data for Chemical-Consuming Industries

	Sept., 1934	Sept., 1933	Jan.-Sept., 1934	Jan.-Sept., 1933	Per Cent of Gain Jan.-Sept., 1934
Production					
Automobiles, No.	168,872	191,800	2,384,596	1,644,126	45.0
Byproduct coke, 1000 tons	2,175	2,712	23,831	19,340	23.2
Glass containers, 1000 gr.	2,860	2,158	26,879	17,165	56.6
Plate glass, 1000 sq.ft.	6,738	8,925	69,319	69,729	* 0.06
Cottonseed oil, crude, 1000 lb.	133,970	159,198	745,248	882,181	*15.5
Cottonseed oil, refined, 1000 lb.	81,050	78,339	748,063	803,078	*6.9
Linseed oil, 1000 lb.	85,037†	113,413†	280,515	272,042	3.1
Pyroxylin spread, 1000 lb.	3,294	2,761	34,418	29,037	18.5
Rosin wood, bbl.	43,095	43,213	385,636	300,709	28.2
Turpentine, wood, bbl.	6,798	6,642	62,562	47,715	31.1
Pneumatic tires, 1000	2,832	3,199	35,907	28,602	25.5
Rubber reclaimed, tons	6,974	9,809	85,395	67,203	27.1
Consumption					
Cotton, 1000 bales	296	499	4,002	4,883	*18.0
Silk, bales	32,599	31,185	334,111	379,125	*12.1
Explosives, sales, 1000 lb.	25,489	25,107	232,750	177,728	30.9
Linseed oil, factory, 1000 lb.	61,218†	70,627†	203,119	185,542	9.5
Paint, varnish and lacquer sales, $1000	22,234	19,098	221,864	171,427	29.4

*Per cent of decline. †Quarter ended Sept. 30.

TRENDS OF PRODUCTION AND CONSUMPTION


PRODUCTION - BYPRODUCT COKE
PRODUCTION - PYROXYLIN SPREAD
RUBBER RECLAIMED
PRODUCTION - PLATE GLASS
COTTON CONSUMED IN TEXTILES
PAINT, VARNISH AND LACQUER SALES
ALCOHOL DENATURED
PRODUCTION - PNEUMATIC AUTOMOBILE TIRES
SULPHURIC ACID CONSUMED IN FERTILIZER
PRODUCTION - GLASS CONTAINERS
PRODUCTION - WOOD PULP
PETROLEUM REFINED
PRODUCTION - METHANOL SYNTHETIC
PRODUCTION - METHANOL CRUDE
EXPLOSIVES SALE
100 = Monthly Average for 1931
1934
1933
Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec.
FOREIGN TRADE IN CHEMICALS AND ALLIED PRODUCTS
Million Dollars
Excess of exports over imports
Exports
Imports
July Aug. Sept. Oct. Nov. Dec. Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec. Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov.
1932
1933
1934

The MARKETS

WITH the improvement in general business which has been noted in the last six weeks, has come a better demand for chemicals and recent trading in the spot market has been much more active so far as some selections are concerned. Inquiry for forward positions likewise has been more pronounced and the possibility that a general uplift in commodity prices may include chemicals which hitherto have been but little influenced by general trends, has been responsible for contract placements and is expected to enliven contract trading up to the end of the year.

Recent fluctuations in values for chemicals have indicated no definite trend although the weighted effect of changes has been in favor of a higher average level. Prices ruling for naval stores in the last month were on a considerably higher plane than had been the case in preceding months. A quota of 450,000 units as the quantity of gum turpentine and gum rosin to be marketed during 1935 by the processors was approved by Secretary of Agriculture Wallace on Nov. 3. Under the terms of the license for the industry the control committee is to set the quota to be marketed each year, such quota to be subject to the disapproval of the Secretary. Approval of the recommendation makes the quota effective.

Members of the domestic chemical industry were interested in the hearing before the Committee for Reciprocity Information which is aiding in negotiating a tariff bargaining treaty with Belgium. It was urged that all chemicals be excluded from the reciprocity program. It was suggested, however, that import duty on imports of palm oil from the Belgian Congo form a basis of bargaining.

Formal approval has been granted since Nov. 1, to the amended hardwood distillation industry code which requires open-price filing of quotations for antifreeze methanol. This provision similar to that in the industrial alcohol code provides also for the distribution of filed prices to all those marketing either commodity.

The Treasury still withholds formal approval of the new industrial alcohol formula intended to permit denaturing with methanol. It is now feared that Secretary Morgenthau's announcement of indefinite postponement amounts essentially to cancellation of this plan. However, vigorous effort to secure methanol-denatured formulas continues.

Serious disruption of normal coconut oil and copra movement from the Philippines to the United States has occurred as a result of the excise tax of 3c. per lb. imposed by the last Congress. Spokesmen of fat-using industries, notably soap makers, are urging in Washington a reconsideration of this tax in order that justice may be done to Philippine producers and an adequate supply of nonedible coconut oil be maintained for use in soap, rubber, white leather, and other chemical-process industries. The President is expected again to ask Congress to give such relief, presumably principally on the basis that good faith with the Philippine people demands this since the Philippine Independence Act virtually promised that no new tariffs or equivalent burdens would be imposed during the interim between acceptance by the Islands and actual consummation of independence. Dairy and southern cottonseed oil interests are opposed to any change.

With tung culture rapidly assuming a place of prominence in agricultural production in the South, the chemical section of the Bureau of Foreign and Domestic Commence is looking for a solvent extraction method. It is wanted for use on next year's crop. Tung oil culture is being pushed in the Southern Gulf States by officials in the Administration connected with agriculture and subsistence homestead planning. Previously commercial interests had already gone in for tung oil culture in Florida, Alabama and Louisiana. Next year's tung crop is expected to be the largest ever produced in this country and a shortage of oil extraction facilities is anticipated. There are at present only two mills in the tung belt extracting oil; one in Florida and the other in Louisiana. Mill extraction of tung oil, according to Government scientists is about 95 per cent efficient. It is hoped, however, that a solvent extraction process as high as 99 per cent efficient can be developed.

New phosphoric acid and fertilizer making facilities of Tennessee Valley Authority are nearing completion. Initial operation is expected within a month. The first used novel units will be the remodeled electric furnaces for making phosphoric acid. Shortly thereafter the complete fertilizer plant is expected to function; but it is not expected that commercial marketing of fertilizer by TVA will be attempted for some time to come. The production of early months' manufacture, no matter how successful, is likely to be used in the soil-erosion program and for cooperative work with those engaged in studies on agronomy.

Increasing use of barter by German chemical manufacturers to promote export trade affected by an acute shortage of foreign exchange has been reported to the Department of Commerce by its foreign representatives. Not only has the practice aided exporters, but it has also facilitated importation of raw and semi-manufactured materials.

Trades that have so far been reported to the Department are: German dyestuffs for Hungarian grain and other agricultural products; chemicals for Bulgarian tobacco; and the importation of Chilean nitrate and iodine for German products and the release of frozen German credits there. Some time ago, Germany concluded a transaction calling for the exchange of commercial fertilizer for Egyptian cotton.

CHEM. & MET. Weighted Index of CHEMICAL PRICES

Base = 100 for 1927

This month	**87.91**
Last month	87.71
November, 1933	86.82
November, 1932	84.61

The price movement was in both directions with higher prices effective for turpentine, calcium arsenate, and lead arsenate and lower prices for acetate of lime, acetic acid, and naphthalene.

CHEM. & MET. Weighted Index of Prices for OILS AND FATS

Base = 100 for 1927

This month	**74.55**
Last month	74.02
November, 1933	53.11
November, 1932	43.15

Declines for linseed, coconut, and China wood oils were more than offset by the strong market for cottonseed, corn, and peanut oils. Animal fats were lower in price.

Current PRICES

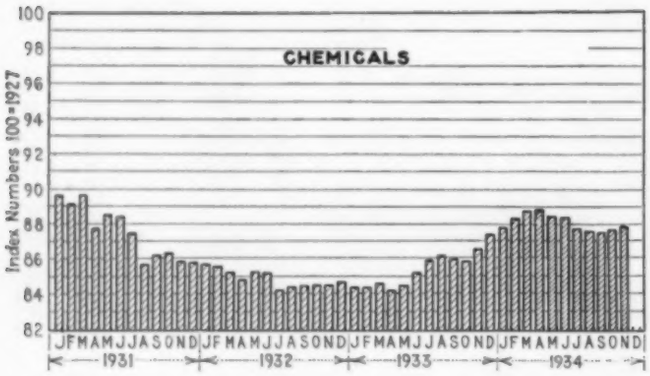
The following prices refer to round lots in the New York market. Where it is the trade custom to sell f.o.b. works, quotations are given on that basis and are so designated. Prices are corrected to Nov. 12.

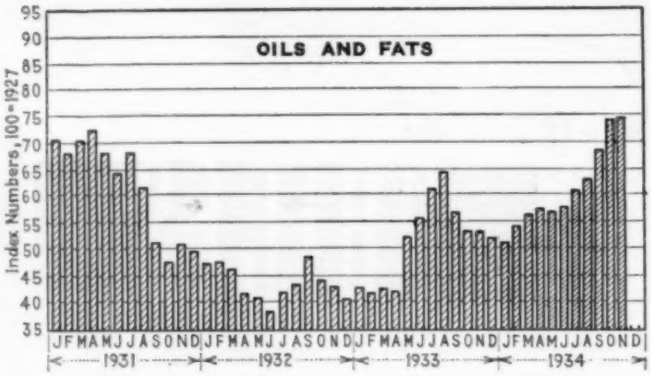
Industrial Chemicals

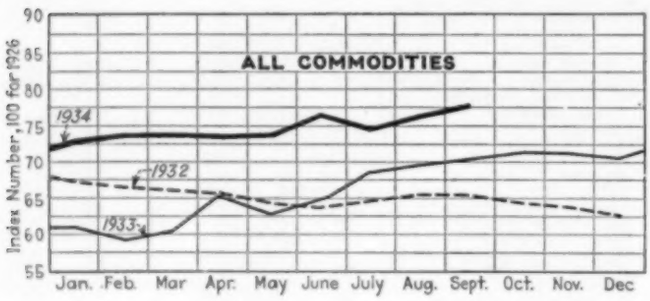
	Current Price	Last Month	Last Year
Acetone, drums, lb.	$0.12 -$0.12½	$0.11 -$0.11½	$0.10 -$0.10½
Acid, acetic, 28%, bbl., cwt.	2.40 - 2.55	2.53 - 2.67	2.90 - 3.15
Glacial 99%, drums	8.25 - 8.50	8.69 - 8.94	10.02 - 10.27
U. S. P. reagent, c'bys.	10.52 -10.77	10.52 -10.77	10.52 -10.77
Boric, bbl., lb.	.04½- .05	.04¾- .05	.04¾- .05
Citric, kegs, lb.	.28 - .31	.28 - .31	.29 - .31
Formic, bbl., lb.	.11 - .11½	.11 - .11½	.11 - .11½
Gallic, tech., bbl., lb.	.60 - .65	.60 - .65	.60 - .65
Hydrofluoric 30% carb., lb.	.07 - .07½	.07 - .07¼	.07 - .07½
Lactic, 44%, tech., light, bbl., lb.	.12 - .12½	.12 - .12½	.11½ - .12
22%, tech., light, bbl., lb.	.06½- .07	.06½- .07	.05½- .06
Muriatic, 18° tanks, cwt.	1.00 - 1.10	1.00 - 1.10	1.00 - 1.10
Nitric, 36°, carboys, lb.	.05 - .05¼	.05 - .05¼	.05 - .05½
Oleum, tanks, wks., ton	18.50 -20.00	18.50 -.....	18.50 -20.00
Oxalic, crystals, bbl., lb.	.11½- .12¼	.11½- .12¼	.11 - .12
Phosphoric, tech., c'bys., lb.	.09 - .10	.09 - .10	.09 - .10
Sulphuric, 60°, tanks, ton	11.00 -11.50	11.00 -11.50	11.00 -11.50
Sulphuric, 66°, tanks, ton	15.50 -.....	15.50 -.....	15.50 -.....
Tannic, tech., bbl., lb.	.23 - .35	.23 - .35	.23 - .35
Tartaric, powd., bbl., lb.	.25 - .26	.25 - .26	.25 - .26
Tungstic, bbl., lb.	1.40 - 1.50	1.40 - 1.50	1.40 - 1.50
Alcohol, Amyl	.....	.....	.....
From Pentane, tanks, lb.	.143-	.143-	.15 - .....
Alcohol, B tyl, tanks, lb.	.12 -	.12 -	.095- .....
Alcohol, Ethyl, 190 p'f., bbl., gal	4.15½-	4.15½-	2.53½- .....
Denatured, 190 proof	.....	.....	.....
No. 1 special, dr., gal.	.346-	.346-	.33½- .....
No. 5, 188 proof, dr., gal.	.34 -	.34 -	.34 - .....
Alum, ammonia, lump, bbl., lb.	.03 - .04	.03 - .04	.03 - .04
Chrome, bbl., lb.	.04½- .05	.04½- .05	.04½- .05
Potash, lump, bbl., lb.	.03 - .04	.03 - .04	.03 - .04
Aluminum sulphate, com., bag cwt.	1.35 - 1.50	1.35 - 1.50	1.25 - 1.40
Iron free, bg., cwt.	1.90 - 2.00	1.90 - 2.00	1.90 - 2.00
Aqua ammonia, 26°, drums lb	.02½- .03	.02½- .03	.02½- .03
tanks, lb.	.02½- .02¾	.02½- .02¾	.02½- .02¾
Ammonia, anhydrous, cyl., lb.	.15½- .16	.15½- .16	.15½- .15¾
tanks, lb.	.04¼-	.04¼-	.05 - .....
Ammonium carbonate, powd tech., casks, lb.	.0! - .12	.08 - .12	.08 - .12
Sulphate, wks., cwt.	1.20 -.....	1.20 -.....	1.20 -.....
Amylacetate tech., tanks, lb., gal	.142-	.142-	.145- .....
Antimony Oxide, bbl., lb.	.09½- .09¾	.09 - .09½	.08 - .09
Arsenic, white, powd., bbl., lb.	.03½- .04	.04 - .04¼	.04 - .04½
Red, powd., kegs, lb.	.15¾- .16	.15 - .15½	.14 - .15
Barium carbonate, bbl., ton	56.50 -58.00	56.50 -58.00	56.50 -58.00
Chloride, bbl., ton	74.00 -75.00	74.00 -75.00	61.50 -63.50
Nitrate, cask, lb.	.08½- .09	.08½- .09	.07½- .07¾
Blanc fixe, dry, bbl., lb.	.03½- .04	.03½- .04	.03½- .04
Bleaching powder, f.o.b., wks. drums, cwt.	1.85 - 2.00	1.85 - 2.00	1.75 - 2.00
Borax, grain, bags, ton	40.00 -45.00	40.00 -45.00	40.00 -45.00
Bromine, cs., lb.	.36 - .38	.36 - .38	.36 - .38
Calcium acetate, bags	2.00 -.....	2.25 -.....	3.00 -.....
Arsenate, dr., lb.	.06 - .07	.05 - .07	.07 - .08
Carbide drums, lb.	.05 - .06	.05 - .06	.05 - .06
Chloride, fused, dr., wks., ton	17.50 -.....	17.50 -.....	17.50 -.....
flake, dr., wks., ton	19.50 -.....	19.50 -.....	19.50 -.....
Phosphate, bbl., lb.	.07½- .08	.07½- .08	.07½- .08
Carbon bisulphide, drums, lb.	.05½- .08½	.05½- .06	.05½- .06
Tetrachloride drums, lb.	.05½- .08½	.05½- .06	.05½- .06
Chlorine, liquid, tanks, wks., lb.	.0185-	.0185-	.01¾- .....
Cylinders	.05½- .06	.05½- .06	.05½- .06
Cobalt oxide, cans, lb.	1.25 - 1.30	1.25 - 1.30	1.15 - 1.25
Copperas, bgs., f.o.b. wks., ton.	14.00 -15.00	14.00 -15.00	14.00 -15.00
Copper carbonate, bbl., lb.	.08½- .16	.08½- .16	.08¼- .16
Cyanide, tech., bbl., lb.	.37 - .38	.37 - .38	.39 - .44
Sulphate, bbl., cwt.	3.85 - 4.00	3.85 - 4.00	3.75 - 4.00
Cream of tartar, bbl., lb.	.18½- .19	.18½- .19	.18 - .18½
Diethylene glycol, dr., lb.	.14 - .16	.14 - .16	.14 - .16
Epsom salt, dom., tech., bbl., cwt	2.10 - 2.15	2.10 - 2.15	2.10 - 2.15
Imp., tech., bags, cwt.	2.00 - 2.10	2.00 - 2.10	2.00 - 2.10
Ethyl acetate, drums, lb.	.08½-	.08½-	.08¼- .....
Formaldehyde, 40%, bbl., lb.	.06 - .07	.06 - .07	.06 - .07
Furfural, dr., contract, lb.	.10 - .17¼	.10 - .17¼	.10 - .17½
Fusel oil, crude, drums, gal.	.75 -.....	.75 -.....	.75 -.....
Refined, dr., gal.	1.25 - 1.30	1.25 - 1.30	1.25 - 1.30
Glaubers salt, bags, cwt.	1.00 - 1.10	1.00 - 1.10	1.00 - 1.10
Glycerine, c.p., drums, extra, lb	.14 - .14½	.14 - .14½	.10½- .10¾
Lead:			
White, basic carbonate, dry casks, lb.	.06½-	.06½-	.06½- .....
White, basic sulphate, sck., lb.	.06 -.....	.06 -.....	.06 -.....
Red, dry, sck., lb.	.06½-	.06½-	.07½- .....
Lead acetate, white crys., bbl., lb.	.10½- .11	.10½- .11	.10½- .11
Lead arsenate, powd., bbl., lb.	.09 - .10	.07 - .09	.10 - .13
Lime, chem., bulk, ton	8.50 -.....	8.50 -.....	8.50 -.....
Litharge, pwd., csk, lb.	.05½-	.05½-	.06½- .....
Lithophone, bags, lb.	.04½- .05	.04½- .05	.04½- .05
Magnesium carb., tech., bags, lb.	.06 - .06¼	.06 - .06¼	.05½- .06
Methanol, 95%, tanks, gal.	.33 -.....	.33 -.....	.33 -.....
97%, tanks, gal.	.34 -.....	.34 -.....	.34 -.....
Synthetic, tanks, gal.	.35½-	.35½-	.35½- .....
Nickel salt, double, bbl., lb.	.11½- .12	.11½- .12	.12 - .12½
Orange mineral, csk., lb.	.09½-	.09½-	.10½- .....
Phosphorus, red, cases, lb.	.44 - .45	.44 - .45	.45 - .46
Yellow, cases, lb.	.28 - .32	.28 - .32	.28 - .32
Potassium bichromate, casks, lb.	.07½- .08¼	.07½- .08¼	.07½- .08
Carbonate, 80-85%, calc. csk., lb	.07 - .07¼	.07 - .07¼	.06½- .07
Chlorate, powd., lb.	.09½- .10	.09½- .10	.08½- .08¾
Hydroxide (c'stic potash) dr., lb	.06¼- .06½	.06¼- .06½	.07½- .07¾
Muriate, 80% bgs., ton	22.00 -.....	22.00 -.....	37.15 -.....
Nitrate, bbl., lb.	.05½- .06	.05½- .06	.05½- .06
Permanganate, drums, lb.	.18½- .19	.18½- .19	.17½- .18
Prussiate, yellow, casks, lb.	.18 - .19	.18 - .19	.16½- .17
Sal ammoniac, white, casks, lb.	.04½- .05	.04½- .05	.04½- .05
Salsoda, bbl., cwt.	1.00 - 1.05	1.00 - 1.05	.90 - .95
Salt cake, bulk, ton	13.00 -15.00	13.00 -15.00	13.00 -15.00
Soda ash, light, 58%, bags, contract, cwt.	1.23 -.....	1.23 -.....	1.20 -.....
Dense, bags, cwt.	1.25 -.....	1.25 -.....	1.22½- .....
Soda, caustic, 76%, solid, drums contract, cwt.	2.60 - 3.00	2.60 - 3.00	2.50 - 2.75
Acetate, works, bbl., lb.	.04½- .05	.04½- .05	.04½- .05
Bicarbonate, bbl., cwt.	1.85 - 2.00	1.85 - 2.00	1.85 - 2.00
Bichromate, casks, lb.	.05½- .06¼	.05½- .06¼	.05 - .05½
Bisulphate, bulk, ton	14.00 -16.00	14.00 -16.00	14.00 -16.00
Bisulphite, bbl., lb.	.03 - .04	.03 - .04	.03½- .04
Chlorate, kegs, lb.	.06½- .06¾	.06¼- .06½	.05½- .07½
Chloride, tech., ton	12.00 -14.75	12.00 -14.75	12.00 -14.00
Cyanide, cases, dom., lb.	.15½- .16	.15½- .16	.15½- .16
Fluoride, bbl., lb.	.07½- .08	.07½- .08	.07 - .08
Hyposulphite, bbl., lb.	2.40 - 2.50	2.40 - 2.50	2.40 - 2.50
Metasilicate, bbl., cwt.	3.25 - 3.40	3.25 - 3.40	3.25 - 3.40
Nitrate, bags, cwt.	1.24 -.....	1.24 -.....	1.295- .....
Nitrite, casks, lb.	.07½- .08	.07½- .08	.07½- .08
Phosphate, dibasic, bbl., lb.	.022- .024	.022- 0.24	.02 - .023
Prussiate, yel. drums, lb.	.11¼- .12	.11¼- .12	.11½- .12
Silicate (40° dr.) wks. cwt.	.80 - .85	.80 - .85	.80 - .85
Sulphide, fused, 60-62%, dr., lb	.02¾- .03½	.02¾- .03	.02¾- .03
Sulphite, cyrs., bbl., lb.	.02½- .02¾	.02½ .02¾	.03 - .03¼
Sulphur, crude at mine, bulk, ton	18.00 -.....	18.00 -.....	18.00 -.....
Chloride, dr., lb.	.03½- .04	.03½- .04	.03½- .04
Dioxide, cyl., lb.	.07 - .07½	.07 - .07½	.06½- .07
Flour, bag, cwt.	1.60 - 3.00	1.60 - 3.00	1.55 - 3.00
Tin Oxide, bbl. lb.	.56 -.....	.56 -.....	.52 -.....
Crystals, bbl., lb.	.38 -.....	.38 -.....	.40 -.....
Zinc chloride, gran., bbl., lb.	.05½- .06	.05½- .06	.05½- .06
Carbonate, bbl., lb.	.09½- .11	.09½- .11	.09½- .11
Cyanide, dr., lb.	.38 - .42	.38 - .42	.38 - .42
Dust, bbl., lb.	.059- .07	.059- .07	.07 - .07½
Zinc oxide, lead free, bag, lb.	.06½-	.06½-	.05¾- .....
5% lead sulphate, bags, lb.	.06½-	.06½-	.05½- .....
Sulphate, bbl., cwt.	2.75 - 3.00	2.75 - 3.00	3.00 - 3.25

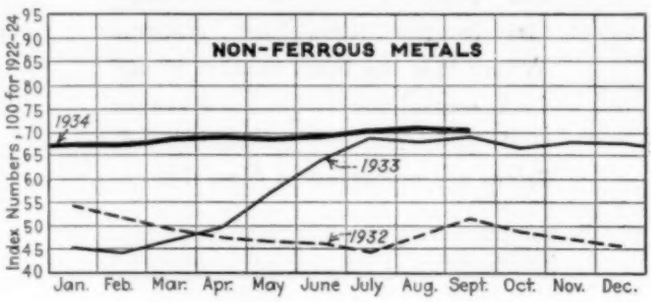
Oils and Fats

	Current Price	Last Month	Last Year
Castor oil, No. 3, bbl., lb.	$0.09½-$0.10	$0.09½-$0.10	$0.09½-$0.10
Chinawood oil, bbl., lb.	.08¾-	.09½-	.08 -.....
Coconut oil, Ceylon, tanks, N. Y. lb.	.03¾-	.03¾-	.03¾- .....
Corn oil crude, tanks, (f.o.b. mill), lb	.07¼-	.07¼-	.04 -.....
Cottonseed oil, crude (f.o.b. mill), tanks, lb.	.07½-	.07 -.....	.03½- .....
Linseed oil, raw car lots, bbl., lb.	.087-	.093-	.097- .....
Palm, Lagos, casks, lb.	.03½-	.03½-	.04 -.....
Palm Kernel, bbl., lb.	.03½-	.03½-	.04 -.....
Peanut oil, crude, tanks (mill), lb.	.07¾-	.07¾-	.03¾- .....
Rapeseed oil, refined, bbl., gal.	.41 - .42	.42 - .43	.42 - .43
Soya bean, tank, lb.	.06½-	.06½-	.06½- .....
Sulphur (olive foots), bbl., lb.	.07½-	.07¾-	.06½- .....
Cod, Newfoundland, bbl., gal.	.38 -.....	.38 -.....	.33 -.....
Menhaden, light pressed, bbl., lb.	.056-	.056-	.53 -.....
Crude, tanks (f.o.b. factory), gal.	.22 -.....	.22 -.....	.13 -.....
Grease, yellow, loose, lb.	.04'	.04¾-	.02¾- .....
Oleo stearine, lb.	.08½-	.10 -.....	.05½- .....
Red oil, distilled, d.p. bbl., lb.	.07 -.....	.07 -.....	.06½- .....
Tallow, extra, loose, lb.	.04¼-	.05¾-	.03 -.....









Coal-Tar Products

	Current Price	Last Month	Last Year
Alpha-naphthol, crude, bbl., lb.	$0.60 -$0.65	$0.60 -$0.65	$0.60 -$0.62
Refined, bbl., lb.	.80 - .85	.80 - .85	.80 - .85
Alpha-naphthylamine, bbl., lb.	.32 - .34	.32 - .34	.32 - .34
Aniline oil, drums, extra, lb.	.14½- .15	.14½- .15	.14½- .15
Aniline salts, bbl., lb.	.24 - .25	.24 - .25	.24 - .52
Benzaldehyde, U.S.P., dr., lb.	1.10 - 1.25	1.10 - 1.25	1.10 - 1.25
Benzidine base, bbl., lb.	.65 - .67	.65 - .67	.65 - .67
Benzoic acid, U.S.P., kgs. lb.	.48 - .52	.48 - .52	.48 - .52
Benzyl chloride, tech., dr., lb.	.30 - .35	.30 - .35	.30 - .35
Benzol, 90% tanks, works, gal.	.19 - .20	.19 - .20	.22 - .23
Beta-naphthol, tech., drums, lb.	.22 - .24	.22 - .24	.22 - .24
Cresol, U. S. P., dr., lb.	.11 - .11½	.11 - .11½	.10½- .11
Cresylic acid, 97%, dr., wks., gal.	.50 - .51	.50 - .51	.45 - .46
Diethylaniline, dr., lb.	.55 - .58	.55 - .58	.55 - .58
Dinitrophenol, bbl., lb.	.29 - .30	.29 - .30	.29 - .30
Dinitrotoluen, bbl. lb.	.16 - .17	.16 - .17	.16 - .17
Dip oil 25% dr., gal.	.23 - .25	.23 - .25	.23 - .25
Diphenylamine, bbl., lb.	.38 - .40	.38 - .40	.38 - .40
H-acid, bbl., lb.	.65 - .70	.65 - .70	.65 - .70
Naphthalene, flake, bbl., lb.	.05½- .06½	.06 - .07	.04½- .05
Nitrobensene, dr., lb.	.08½- .09	.08½- .09	.08½- .10
Para-nitraniline, bbl., lb.	.51 - .55	.51 - .55	.51 - .55
Phenol, U.S.P., drums, lb.	.14½- .15	.14½- .15	.14½- .15
Picric acid, bbl., lb.	.30 - .40	.30 - .40	.30 - .40
Pyridine, dr., gal.	1.10 - 1.15	1.10 - 1.15	.90 - .95
Resorcinal, tech., kegs, lb.	.65 - .70	.65 - .70	.65 - .70
Salicylic acid, tech., bbl., lb.	.40 - .42	.40 - .42	.40 - .42
Solvent naphths, w.w., tanks, gal.	.26 -.....	.26 -.....	.26 -.....
Toluidine, bbl., lb.	.88 - .90	.88 - .90	.88 - .90
Toluene, tanks, works, gal.	.30 -.....	.30 -.....	.30 -.....
Xylene, com., tanks, gal.	.26 -.....	.26 -.....	.26 -.....

Miscellaneous

	Current Price	Last Month	Last Year
Barytes, grd., white, bbl., ton.	$22.00-$25.00	$22.00-$25.00	$22.00-$25.00
Casein, tech., bbl., lb.	.09½- .10	.11½- .13	.12½- .13
China clay, dom., f.o.b mine, ton	8.00 -20.00	8.00 -20.00	8.00 -20.00
Dry colors:			
Carbon gas, black (wks.), lb.	.04 - .20	.04 - .20	.02½- .20
Prussian blue, bbl., lb.	.35½- .37	.35½- .37	.35 - .36
Ultramine blue, bbl., lb.	.06 - .32	.06 - .32	.06 - .32
Chrome green, bbl., lb.	.26 - .27	.26 - .27	.27 - .30
Carmine red, tins, lb.	4.00 - 4.40	4.00 - 4.40	3.65 - 3.75
Para toner, lb.	.80 - .85	.80 - .85	.75 - .80
Vermilion, English, bbl., lb.	1.56 - 1.58	1.60 - 1.62	1.35 - 1.40
Chrome yellow, C. P., bbl., lb.	.15 - .16	.15 - .15½	.15 - .15½
Feldspar, No. 1 (f.o.b. N.C.), ton	6.50 - 7.50	6.50 - 7.50	6.50 - 7.50
Graphite, Ceylon, lump, bbl., lb.	.07 - .08½	.07 - .08½	.07 - .08½
Gum copal Congo, bags, lb.	.09 - .10	.09 - .10	.06 - .08
Manila, bags, lb.	.09 - .10	.09 - .10	.16 - .17
Damar, Batavia, cases, lb.	.15½- .16	.15½- .16	.16 - .16½
Kauri No. 1 cases, lb.	.20 - .25	.20 - .25	.45 - .48
Kieselguhr (f.o.b. N.Y.), ton.	50.00 -55.00	50.00 -55.00	50.00 -55.00
Magnesite, calc, ton.	50.00 -.....	50.00 -.....	40.00 -.....
Pumice stone, lump, bbl., lb.	.05 - .07	.05 - .08	.05 - .07
Imported, casks, lb.	.03 - .40	.03 - .40	.03 - .35
Rosin, H., bbl.	5.65 -.....	5.75 -.....	5.15 -.....
Turpentine, gal.	.53 -.....	.53½-.....	.48½-.....
Shellac, orange, fine, bags, lb.	.35 -.....	.35 -.....	.24 - .25
Bleached, bonedry, bags, lb.	.30 - .31	.32 -.....	.24 - .25
T. N. bags, lb.	.22 - .24	.26 - .27	.13 - .14
Soapstone (f.o.b. Vt.), bags, ton	10.00 -12.00	10.00 -12.00	10.00 -12.00
Talc, 200 mesh (f.o.b. Vt.), ton.	8.00 - 8.50	8.00 - 8.50	8.00 - 8.50
300 mesh (f.o.b Ga.), ton.	7.50 -10.00	7.50 -10.00	7.50 -11.00
225 mesh (f.o.b. N. Y.), ton.	13.75 -.....	13.75 -.....	13.75 -.....

INDUSTRIAL NOTES

WILSON & BENNETT MFG. CO., Chicago, announces the completion of its new factory at 353 Danforth Ave., Jersey City, N. J., for production of steel barrels, etc. J. C. Bennett, vice-president and general sales manager, is in charge of the new plant.

STRUTHER-WELLS CO., Warren, Pa., has appointed W. V. C. Jackson district sales representative in Oklahoma, Kansas, and the eastern part of Texas. His headquarters will be in the National Bank of Tulsa Bldg., Tulsa, Okla.

PHILADELPHIA QUARTZ CO., Philadelphia, reports that its representative F. Horner Bell has changed his headquarters from St. Louis to Atlanta, Ga.

COMBUSTION ENGINEERING CO., New York, has established a western division of its sales organization. Roger W. Andrews will be in charge of the new division.

GILBY WIRE CO., Newark, N. J., has formed a new French company to take over its European business. The new company is the Gilby Wire Société Anonyme with main office at 11 bis Rue d'Aguesseau, Paris, and with plant at Puteau.

THE HARBISON-WALKER REFRACTORIES CO., Pittsburgh, has announced the acquisition of the American rights to the forsterite patents of Goldschmidt and his associates through an exclusive royalty granted by Dr. Victor M. Goldschmidt of Göttingen, Germany. These patents cover refractories made of olivine and of the other magnesium silicates. Included in the group are more than a dozen United States and Canadian patents.

THE E. I. DU PONT DE NEMOURS & CO., Wilmington, Del., has awarded the Koppers Construction Co. a contract for a Thylox process liquid purification plant to be built at Belle, W. Va. This plant, which will be the largest of its type in the world, is designed to purify blue gas and to remove ninety-nine per cent plus of the hydrogen sulphide contained in this gas. The plant will have a capacity to purify 45,000,000 cu.ft. of gas per day.

MAGNETIC MFG. CO., Milwaukee, has appointed Garrett Burgess, Inc., 5050 Joy Road, Detroit, as its representative in the Detroit territory.

CARBONDALE MACHINE CO., Carbondale, Pa., and Worthington Pump and Machinery Corp., Harrison, N. J., have consolidated their interests in the general refrigeration field, in the future operating as the Carbondale Machine Corp., with manufacturing at the Worthington plant in Harrison.

PURE CARBONIC, INC., New York, is now operating a warehouse at 215 North Detroit St., Tulsa, Okla., for direct sale of Pure Carbonic and Dry Ice products.

New CONSTRUCTION

Where Plants Are Being Built in Process Industries

	—Current Projects—		—Cumulative to Date—	
	Proposed Work and Bids	Contracts Awarded	Proposed Work and Bids	Contracts Awarded
New England	$56,000	$28,000	$1,248,000	$1,474,000
Middle Atlantic	213,000	233,000	4,814,000	4,701,000
South	126,000	.....	13,392,000	7,873,000
Middle West	580,000	150,000	9,623,000	2,215,000
West of Mississippi	65,000	95,000	15,931,000	937,000
Far West	1,187,000	300,000	4,559,000	1,696,000
Canada	786,000	28,000	4,982,000	1,924,000
Total	$3,013,000	$834,000	$54,549,000	$20,820,000

PROPOSED WORK BIDS ASKED

Auto Enamel Factory—E. I. DuPont de Nemours & Co., Wilmington, Del., has acquired the plant of the former Mountain Varnish & Color Co., at Toledo, Ohio, and plans to recondition and enlarge same for the manufacture of enamel for automobiles. Estimated cost including equipment $225,000.

Distillery — Corporation, c/o H. Hartman, Belleville, Ill., plans to construct a distillery here. Estimated cost $30,000.

Distillery—Corporation, c/o R. Lee Mahaley, Salisbury, N. C., and C. M. Little, Richmond-Petersburg Hy., Richmond, Va., plans to construct a corn liquor distillery at Richmond to have a daily capacity of 12,000 gal. Estimated cost $40,000.

Distillery — Cove Spring Distilling Co., 20 West 40th St., New York, N. Y., contemplates the construction of a distillery at Frankfort, Ky. Estimated cost to exceed $30,000.

Distillery—Monumental Distillery, G. R. Vincenti, Pres., Monumental Sta., Lansdowne, Md., plans to construct a distillery. Estimated cost exceeds $35,000.

Distillery—Romeo Malatesta, 529 Bway., New York, N. Y., plans to construct a distillery at Sanger (Fresno Co.), Calif. Estimated cost exceeds $30,000.

Distillery—North American Distillers, E. A. Loveley, Pres., St. Clair, Mich., contemplates the construction of a distillery here. Estimated cost $200,000.

Distillery—St. Croix Distilling Co., 25 West 43rd St., New York, N. Y., plans to construct a distillery at Garwood, N. J. Estimated cost $40,000.

Factory—Great Southern Lumber Co., Bogalusa, La., plans to construct a factory and will equip same with machinery for extracting oil from tung nuts.

Fertilizer Plant—Sowega Fertilizer Assn. and Sowega Melon Assn., Valdosta, Ga., plan to construct a fertilizer plant at Valdosta. Estimated cost $30,000.

Laboratory — Department of Sanitation, Municipal Bldg., New York, N. Y., is having plans prepared by W. D. Binger, Archt., c/o Owner, for the constuction of a 5 story, 49x90 ft. laboratory and office building on Avenue Z near Bragg St., Brooklyn, N. Y. Estimated cost $88,00.

Chemical Laboratory—Trinity College, Hartford, Conn., will take bids after Dec. 1, for the construction of a chemical laboratory. McKim Mead & White, 101 Park Ave., New York, N. Y., are architects.

Laboratory—Worcester City Hospital, Clifford Anderson, Chairman, Bd. Trustees, Worcster, Mass., is having plans prepaed by Stevens, Curtin & Mason, 45 Newbury St., Boston, Mass., for the construction of a hospital including a laboratory. Estimated cost $600,000.

Physical Science Building—Long Beach Board of Education, Long Beach, Calif., plans to construct Physical Science and Chemistry Buildings at Long Beach Junior College, Carson St. and Clark Ave., Long Beach. K. Cutter, Farmers and Merchants Bank Bldg., Archt., and J. H. Davies and C. D. Wailes, Jr., Ocean Center Bldg., Engrs., both in Long Beach. Estimated cost $157,000.

Oxygen Factory—St. Louis Oxygen Co., formerly located at 2500 Montgomery St., St. Louis, Mo., has purchased a new factory building at 1522-30 South Vandeventer Ave., St. Louis, and will equip it for the manufacture of commercial oxygen, hydrogen and acetylene. The company will purchase considerable new equipment.

Pharmaceutical Factory—Bristol Myers Co. of Canada, Ltd., W. H. Laidley, Mgr., 1239 Benoit St., Montreal, Que., Can., plans the construction of a factory for the manufacture of pharmaceutical preparations.

Paper Mill — Badger Paper Co., Peshtigo, Wis., will soon award the contract for an addition to its mill. Estimated cost including equipment $50,000.

Pottery Plant — French-Saxon Pottery Co., Sebring, Ohio, plans to construct a new tunnel giost kiln at its plant here. Estimated cost $75,000.

Gasoline Refinery—Texon Royalty Co., Agua Dulce Oil Fields, Agua Dulce, Tex., plans to construct a gasoline refinery and carbon black plant, here. Estimated cost $30,000.

Refinery—National Refining Co., Sarnia, Ont., Can., plans to recondition its refinery here. Estimated cost $350,000.

Refinery — Sloan and Zook Companies, 101 Main St., Bradford, Pa., H. K. Dougherty, Engr., plans to install air and gas pressure plants for recovery of crude oil fom wells at various locations in Warren, Crawford and Venango Counties, Pa. Companies plan a large expenditure for this work.

Salt Factory—Geoffrey C. Walker, Port Frank, Ont., Can., is incorporating the Walker Salt Corp. with a capital stock of $250,000, and plans to erect and equip a plant here for developing the salt deposits. Prices are wanted on all equipment.

Starch Products Plant—Stein-Hall & Co., 285 Madison Ave., New York, N. Y., has acquired a factory at Toronto, Ont., Can., and plans to recondition and equip same for the manufacture of starch products. Estimated cost $30,000.

Sugar Refinery—Amalgamated Sugar Co., H. A. Banning, Vice-President, Ogden, Utah, has acquired a 75 acre site at Clarksburg, Calif., and plans to construct a sugar refinery including warehouses, cattle pens and miscellaneous smaller structures. Estimated cost $1,000,000.

Sulphide Pulp Mill—R. O. Sweezy, Montreal, Que., Can., is having plans prepared for the construction of a sulphide pulp mill at Vancouver, B. C. Project will mature in 1935. Estimated cost $350,000.

CONTRACTS AWARDED

Chemical Factory—Champion Chemical Co., R. N. Lupfer, Secy., Springfield, O., awarded contract for factory at Monroe and Linden Sts., Springfield, to Green & Sawyer, Lima, O. Estimated cost $60,000.

Graphite Factory — Acheson Graphite Co., Niagara Falls, N. Y., awarded contract for graphite factory, to W. S. Johnson Building Co., Niagara Falls. Estimated cost exceeds $100,000.

Leather Factory—S. L. Agoos Tanning Co., Inc., 14 Franklin St., Salem, Mass., awarded contract for addition to factory to Noble, Little, 8 Eagan Pl., Peabody, Mass. $35,000.

Paper Factory—Continental Paper Products, Ltd., Wellington St., Ottawa, Ont., Can., awarded contract for addition to factory to Foundation Co. of Canada Ltd., Montreal, Que., Can. $35,000.

Paper Factory—Fort Howard Paper Co., Green Bay, Wis., awarded contract for addition to factory to Selmer & Co., Green Bay. $60,000.

Paper Factory—Scott Paper Co., Chester, Pa., awarded contract for paper factory to Wark & Co., 1608 Walnut St., Philadelphia, Pa. Estimated cost exceeds $28,000.

Pottery Plant—Edwin Bennett Pottery Co., 600 South Eden St., Baltimore, Md., awarded contract for 1 story, dry kiln to J. L. Robinson Construction Co., Loch Raven Blvd., Baltimore. $30,000.

Refinery—Max Pray, Wyman, Mich., will build petroleum refinery and skimming plant in Montcalm County, by day labor. $30,000.

Refinery—Rado Refining Co., c/o W. K. Campbell, McAllen, Tex., plans to enlarge its refinery. Work will be done by company forces. $40,000.

Refinery—Republic Oil Refining Co., Texas City, Tex., will build an oil refinery. Separate contracts have been awarded for the work. $30,000.

Oil Treatment Plant—Standard Oil Co. of California, 225 Bush St., San Francisco, Calif., awarded contract for solvent plant for treatment of lubricating oils, to Fluor Corporation, Ltd., 909 East 59th St., Los Angeles. Estimated cost $300,000.

Tin Foil Plant—Johnston Tin Foil & Metal Co., 6108 South Bway., St. Louis, Mo., awarded contract for 1 story top addition to present plant to Jos. E. Stauder, 5405 South Bway., St. Louis. $25,000.

Warehouse — Baltimore Pure Rye Distilling Co., Dundalk, Baltimore, Md., awarded contract for warehouse No. 2, to Cogswell Construction Co., 406 Park Ave., Baltimore, Md. Estimated cost $75,000.

BYPRODUCT COKE

Grizzly Disks: Hard cast iron
Pulverizer Hammer: Stellited
Chute Liners: Vitrified brick, cast iron
Wharf Surfacing: Vitrified brick, hard cast iron, alloyed irons, rubber, tile
Crusher Segments: Special manganese steel, special cast irons, Stellite
Screen Cloth: Ordinary bright wire through piano wire to manganese steel
Pulley Lagging: Rubber
Oven Standpipes and Door Linings: Refractories
Conveyor Galley Covering: Alloy or wrought iron sheet, cement-asbestos board
Quenching Pump Impeller: Monel metal
Valves and Piping: Lead-lined steel
Valve Seats and Disks: Bronze, Stellited
Pump Shafts and Sleeves: Stainless steel
Pusher Shoes: Stellited

CEMENT, PORTLAND

Gyratory Crushers: Manganese steel used for crushing elements to resist abrasion
Hammer Mill: Chilled steel used for breaker plates; tool steel for hammers, Hascrome surfacing
Mills: Rolls and die rings are given a Stellite treatment
Tube Mill Grinding Media and Liner Plates: Manganese steel—resistance to abrasion and ability to take and keep a polish
Screw Conveyor Flights: Stellited to resist abrasion
Kiln Liners: High-alumina material to resist high temperatures. A 25-15 nickel-chrome steel used for feed pipes and burner pipes for same reason
Drag Chain Rider Blocks: Stellited

COAL TAR REFINING

Heavy Oil Wash Tank: Steel. Pumps, Hastelloy C. For general purposes, nickel cast iron
Naphthalene Wash Tank: Lead for treatment with sulphuric and caustic soda. Also Hastelloy A
Benzol Agitators: Steel, 2½-3% nickel steel. Coil, lead. Shell made of cast iron pipe or from steel plate. Lead linings are used in some plants
Benzol Condensers: Aluminum
Crude Tar Acid Still: Steel. Condenser tubes, stainless steel
Phenol Condensers: Nickel, 18-8 Cr-Ni steel, tin, tin-lined, tin coated
Washed Benzol Still: Rectifying columns, cast iron, wrought iron, steel
Heavy Oil Wash Tanks: Steel
Carbonating Tanks: Steel
Tank Cars for Phenol: Nickel-clad steel
Centrifugals: (Used for separating drained creosoting salts from oils) Monel metal, nickel

GLYCERINE

Acid Storage Tanks: Rubber-lined steel, lead-lined steel
Evaporators: Cast iron, steel
Evaporator Tubes & Tube Sheets: Copper, steel
Stills: Steel
Still Coils: Steel, Monel metal, stainless steel
Condenser Tubes: Copper, Admiralty metal, Monel metal
Filter Presses: Cast iron, tin or zinc coated cast iron
Storage Tanks: Stainless-clad steel, tin or zinc coated steel, steel

PHENOLIC RESINS

Stills: Nickel, stainless steel, copper, Monel metal, tin-lined copper, nickel-clad steel, aluminum
Fractionating Columns: Nickel, stainless steel, copper, aluminum
Condensers: Nickel, stainless steel, copper, Monel metal, aluminum
Drums: Stainless steel, nickel-clad steel, galvanized iron, aluminum
Storage Tanks: Enamel, stainless steel, tin-lined copper, nickel, nickel-clad steel
Kneaders: Stainless steel, Monel metal, chromium-plated steel
Rolls: Chromium-clad steel, chromium-plated steel
Varnish Kettles: Monel metal, stainless steel, copper, aluminum, nickel-clad steel
Molds: (for molding material) Stainless steel, chromium-plated steel
Molds: (for casting resins) Lead
Pipe & Valves: Nickel, aluminum, stainless steel, copper

SODA PULP

Digesters: Steel
Wash Tanks: Steel
Black Liquor Vacuum Filter: Monel metal facing and backing wire cloths
Black Liquor Pipe Lines: Nickel cast iron, steel, wrought iron, cast iron
Black Liquor Valves: Nickel cast iron, steel, wrought iron, cast iron
Black Liquor Pumps: Nickel cast iron, steel, wrought iron, cast iron. For pump shafts, Monel metal, stainless steel
Black Liquor Evaporators: Monel metal, stainless steel, Inconel, nickel, steel for tubes, the corrosion resisting materials being used for the effects of multiple effect evaporators handling the more concentrated liquor
Concentrated Black Liquor Storage Tanks: Steel, nickel-clad steel
Rotary Furnaces: Steel cylinders lined with brick. Driven by ring gears and pinions of cast iron containing 2% nickel, 3% total carbon and 1.5% silicon
Cast Lip on Rotating Cylinder: Nickel cast iron, alloy cast iron (3.3% total carbon, 1.5% silicon, 3.5% nickel, 0.3-.4% chromium)
Leaching Tanks: Steel
Green Liquor Valves, Pumps, & Pipe: Cast iron, nickel cast iron
Causticizing Tanks: Steel, nickel-clad steel, Monel metal
Agitators: Steel, cast iron, nickel cast iron
Lime Mud Filters: Monel metal for covering or filter medium
Caustic Evaporators: Iron, steel, nickel, Monel metal, copper for tubes
Bleach Pulp Washers: Monel metal, copper, brass, bronze for washer linings, cylinder molds and filter cloth and winding wire on vacuum filters

Materials of Construction for Process Industries

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Continued from supplement to October *Chem. & Met.*